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INTRODUCTION

Matter is something that occupies space and has its own mass. It is something that can be felt by us. Some examples of matter are air, water, food, table, pen, gold, sand, fruits, plants, trees, bottle, plastic, stones, oil, fan, chair etc. All these things occupy space and have their own masses. Both, living things and non-living things are matter. The entire universe is composed of matter.

However, few things like heat, sound, light, and electricity cannot come under the term matter, because they do not have mass, but they can be useful to do work. Heat can be used to iron clothes, cook food, water, etc. Electricity has multiple uses like making the fans revolve, useful in operating machines, etc. Our eardrums vibrate due to sound. Plant use light to create their food. Light is also useful during the night time to work or study. All these things are forms of energy. Energy means the ability to do work.

Matter can be classified as solid, liquid or gas on the basis of interparticle forces and the arrangement of particles. These three forms of matter are interconvertible by increasing or decreasing pressure and temperature. **For example**, ice can be converted from solid to a liquid by increasing the temperature.

Constituents of Matter

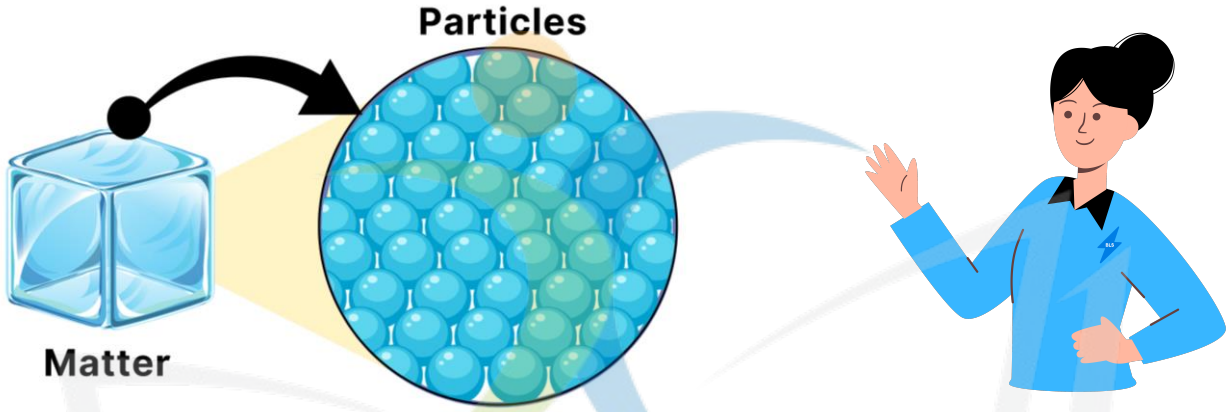
According to the early Indian philosophers, every living and non-living thing is made of five basic elements called the Panchtatva – Air, Water, Earth, Sky, and Fire. Therefore, matter is a composition of these five constituents.

Physical Nature of Matter

Matter Is Made Up of Small Particles

Matter is particulate in nature. This means that matter consists of particles as you can see in the microscopic image of a cube above.

For Example, If we put a drop of red colour in water the colour of the water turns red. This happens because the particles of red colour mix with the particles of water.



How small are these Particles

The size of the particles of matter is very small.

They can be broken into further particles as well. **For Example**, On dilution of a colourful solution, as shown in the figure below, we can still see the colour. This means there are millions of particles present in the colour which just divide themselves on dilution.

Which of these is matter – happiness, air, sandwich, thoughts, juice, and eraser? Air, sandwich, juice, and eraser as they have mass, occupy space and can be broken into further particles.

Characteristics of Particles of Matter

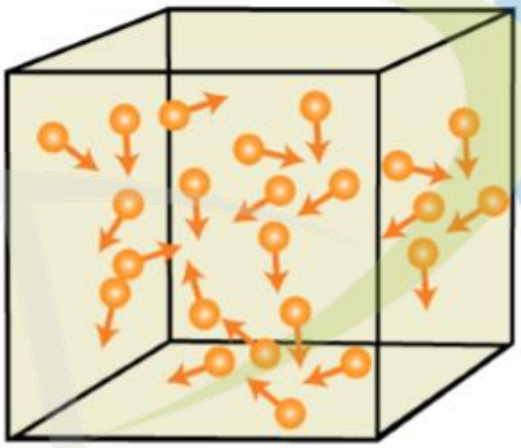
Every substance is made up of particles. These particles exhibit some characteristics. They can influence the state and properties (physical and chemical) of a substance. The three characteristics shown by particles of matter are as follows.

Particles Have Space Between Them

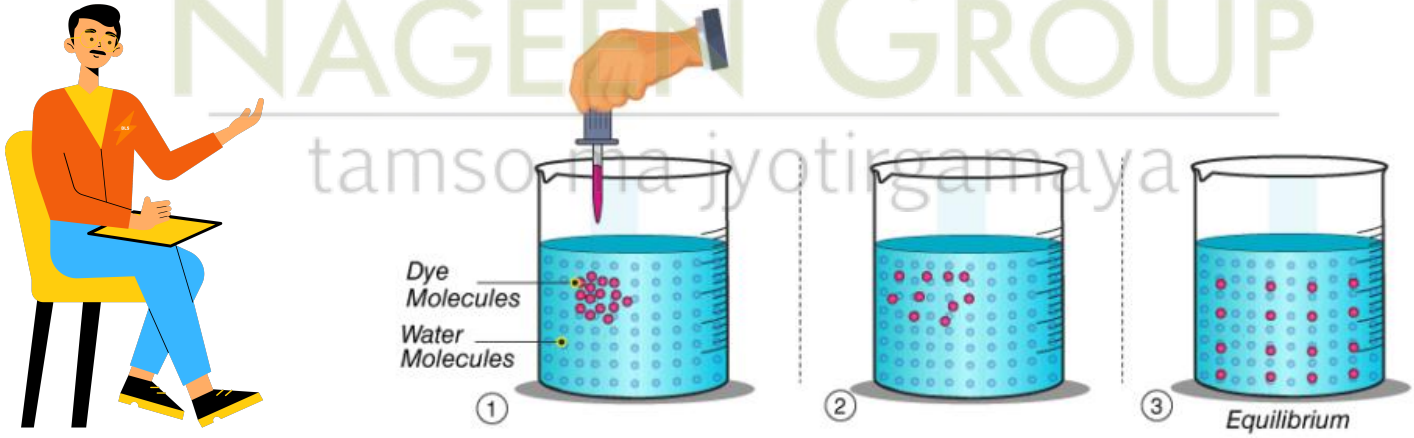
There are small voids between every particle in a matter. This characteristic is the concept behind the solubility of a substance in other substances. Let's try to understand this with an illustration.

Take a glass of water. Put a teaspoon of salt/sugar and mix them properly. You will observe that the water is still clear. This is because the particles of salt/sugar get into the interparticle spaces between the water particles. This proves that there are voids between particles of a substance. If you add more salt/sugar, it will dissolve until all the space between water particles gets filled.

Particles Are Constantly in Motion (or) Particles are Continuously Moving



Particles of the matter show continuous random movements. The kinetic energy they possess helps them in this movement. The spreading of ink in a beaker of glass, the smell that comes from agarbattis, etc. are few illustrations that show the movement of particles of a substance. When the particles of two different types of matter intermix on their own, the phenomenon is called diffusion.



Diffusion

The diffusion of particles becomes fast when the temperature is increased. A rise in temperature increases the kinetic energy of the particles, making them move more vigorously.

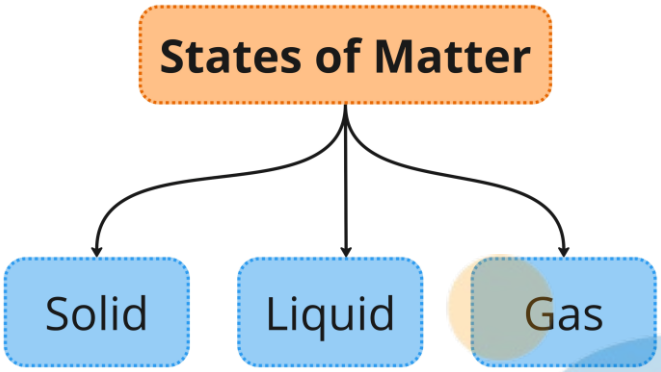
Particles Attract Each Other

Take an iron rod, a stick of chalk, and a pen. Try to break each one of these. Which one of these is easy to break? The iron rod is stronger than the other two items. What makes an item stronger? Yes, it's the particles in them which are held by the inter-particle force of attraction.

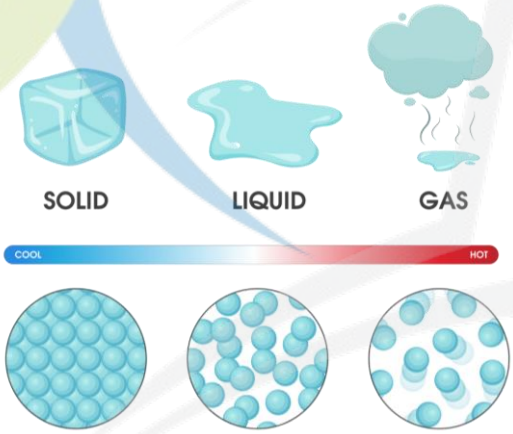
In every substance, there is an inter-particle force of attraction acting between its particles. To break something, we need to overcome this force. The strength of the force differs from one substance to another.

The inter-particle force of attraction and the kinetic energy of the particles primarily determine the physical state of any matter.

STATES OF MATTER



These different states of substances, as well as their state change, is due to various physical properties of them such as intermolecular force, the distance between particles, compressibility, etc which are responsible to determine the state of a matter.



Solids

- The solid state is one of the fundamental states of matter.
- Solids differ from liquids and gases by the characteristic of rigidity.
- The molecules of solids are tightly packed because of strong intermolecular forces; they only oscillate about their mean positions.
- Whereas, liquids and gases possess the property of fluidity and can easily flow.
- Solids can be defined as the state of matter which has definite shape and volume and has a rigid structure.
- Solids possess the least compressibility and thermal expansion.
- Example: Iron (Fe)

Liquids

- The molecules in a liquid are closely packed due to weak intermolecular forces.

- These forces are weaker than solids but stronger than that of gases.
- There is much space in between the molecules of liquids which makes their flowing ability easy.
- Liquids can easily acquire the shape of a vessel, and they have a fixed volume.
- Conversion of solids into liquids takes place when we increase the temperature of solids to a point where solids begin to melt.
- Generally, the density of liquid lies between the density of solids and gases. Compressibility and thermal expansion of liquids are slightly higher than that of solids.
- Example: Water (H_2O)

Gases

- In this state of matter, distances between the molecules are large (intermolecular distance is in the range of $10^{-7} – 10^{-5}$ cm).
- The intermolecular forces experienced between them are negligible.
- Thus, translatory, rotatory and vibratory motions are observed prominently in gases.
- Gases do not have any fixed shape or volume.
- They also possess high compressibility and thermal expansion.
- Example: Oxygen (O_2)

Comparison of properties of Solids, Liquids and Gases

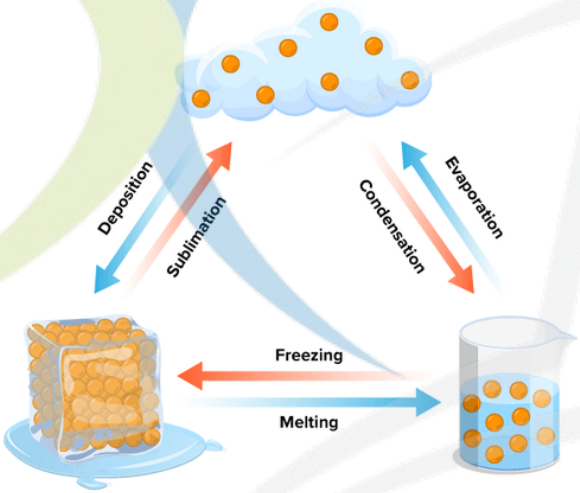
Property	Solid	Liquid	Gas
Shape and volume	Fixed shape and volume	No fixed shape but has volume	Neither definite shape nor volume
Energy	Lowest	Medium	Highest
Compressibility	Difficult	Nearly difficult	Easy
Arrangement of molecules	Regular and closely arranged	Random and little sparsely arranged	Random and more sparsely arranged
Fluidity	Cannot flow	Flows from higher to lower level	Flows in all directions
Movement	Negligible	Depends on interparticle attraction	Free, constant and random
Interparticle space	Very less	More	Large
Interparticle attraction	Maximum	Medium	Minimum
Density	Maximum	Medium	Minimum
Rate of diffusion	Negligible	It depends on interparticle attraction.	Maximum

CHANGE OF STATES OF MATTER

Effect of Change of Temperature

The kinetic energy of matter particles increases as temperature rises, and they begin to vibrate at a higher frequency. As a result, the interparticle force of attraction between particles decreases, and particles become unattached from their positions and free to travel.

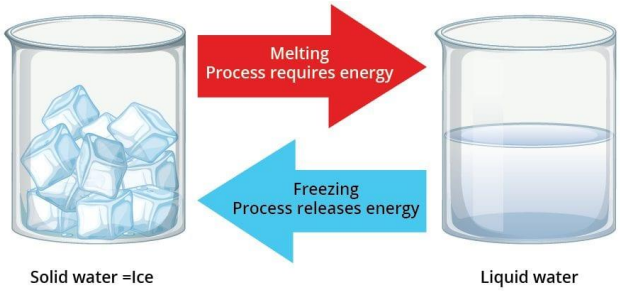
The condition of matter begins to alter as a result. Liquids are formed when solids undergo a phase transition. Liquids, too, go through a phase change to become gases. The processes related to the change of state of matter due to temperature i.e., melting, boiling, etc. are mentioned below.



Melting Point

Melting is a physical process that causes a matter's phase change from solid to liquid. When the internal energy of solid increases, usually due to the application of heat or pressure, the temperature of the matter rises to the melting point. Melting is the transformation of a solid into a liquid. The melting point is the temperature at which something melts.

For example: When ice cubes are removed from the freezer and brought to room temperature, they turn into a liquid. As a result, the ice cube melts and turns into water.

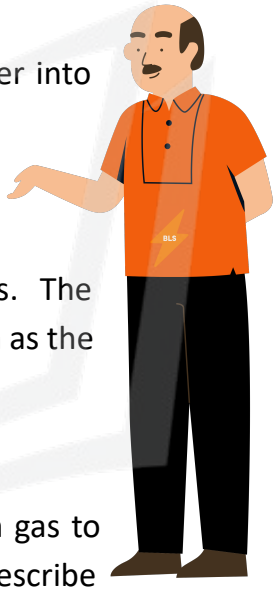


Melting of Ice into Water

Melting occurs: When a solid is heated, it transforms into a liquid. In a solid, the particles gather enough energy to overcome the bonding forces that keep them together. During melting, particles usually begin to move about, keeping close to their neighbours, before moving more freely. The temperature at which this transition takes place in pure substances is known as the melting point of the material.

Boiling Point

Boiling is the fast evaporation of a liquid that occurs when it is heated to its boiling point, which is the temperature at which the liquid's vapour pressure equals the surrounding atmosphere's pressure. Boiling is the transformation of a liquid substance into a gas when heated rapidly. The boiling point is the temperature at which something begins to boil.



For example: "Boiling of water" refers to the quick transformation of water into steam or water vapour when heated.

Boiling Occurs: When particles in a liquid gather enough energy to overcome the bonding forces that hold them loosely together in the liquid, they boil and become free, fast-moving individual particles in a gas. The temperature at which this transition takes place in pure substances is known as the boiling point of the material.

Condensation

Condensation is the process of changing the physical state of matter from gas to liquid. It is the inverse of vaporization. The term is most commonly used to describe the water cycle.

For example: The existence of water droplets on the surface of a glass containing cold water is due to the fact that when airborne water vapour collides with the cold glass of water, it loses its energy and condenses to a liquid state.

Condensation Occurs: When a gas is cooled, the particles stop moving around as quickly and become a liquid. Condensation is a process that happens at the same temperature as boiling. As a result, a substance's boiling point and condensation point are the same temperatures.

Effect of Measuring Temperature

Celsius Scale

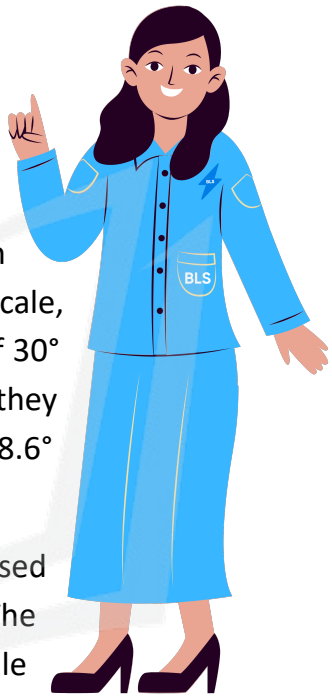
The Celsius scale is also called the centigrade scale, and it is based on 0°C for the freezing point and 100° C for the boiling point of water. Initially, On the Celsius scale, 0° is used to denote the boiling point of water and 100°C to denote the freezing point of water.

Kelvin Scale

The definition of the Kelvin is the fraction of 1/273.16 of the thermodynamic temperature of the triple point of water. The unit of Kelvin or thermodynamic temperature scale is called the Kelvin.

Lord Kelvin defined a scale based on thermodynamic principles that do not depend on the properties of any particular substance. Kelvin divided the interval between the ice and steam points into 100 divisions so that one kelvin represents the same temperature interval as one Celsius degree.

Fahrenheit Scale



This scale is based on 32° for the freezing point of the water and 212° for the boiling point of the water, the interval between the freezing point and the boiling point in being divided into 180 equal parts. The Fahrenheit temperature scale was first introduced in the 18th century by a German physicist named Daniel Gabriel Fahrenheit. Initially, he selected zero of his scale, as the temperature of the ice salt mixture. And then selected the values of 30° and 90° for the freezing point of water and normal body temperature, later they were revised to 32° and 96°. But the final scale requires an adjustment to 98.6° for the latter value.

The Fahrenheit scale is used in the US and the Celsius or centigrade scale is used in most of the other countries, for scientific purposes worldwide. The conversion formula for a temperature that is expressed on the Celsius (°C) scale to its Fahrenheit (°F) formula is given below:

$$°\text{F} = \left(\frac{9}{5} \times °\text{C}\right) + 32.$$

Common reference points on the three temperature scales			
Reference point	**Degrees Fahrenheit**	**Kelvin**	**Degrees Celsius**
Boiling point of water	212	373	100
Body temperature	98.6	310	37
Room temperature	68	293	20
Freezing point of water	32	273	0
Absolute zero	-459	0	-273

Effect of Change of Pressure

By applying pressure, we can bring the particles of matter close to each other thereby, increasing the force of attraction among the particles.

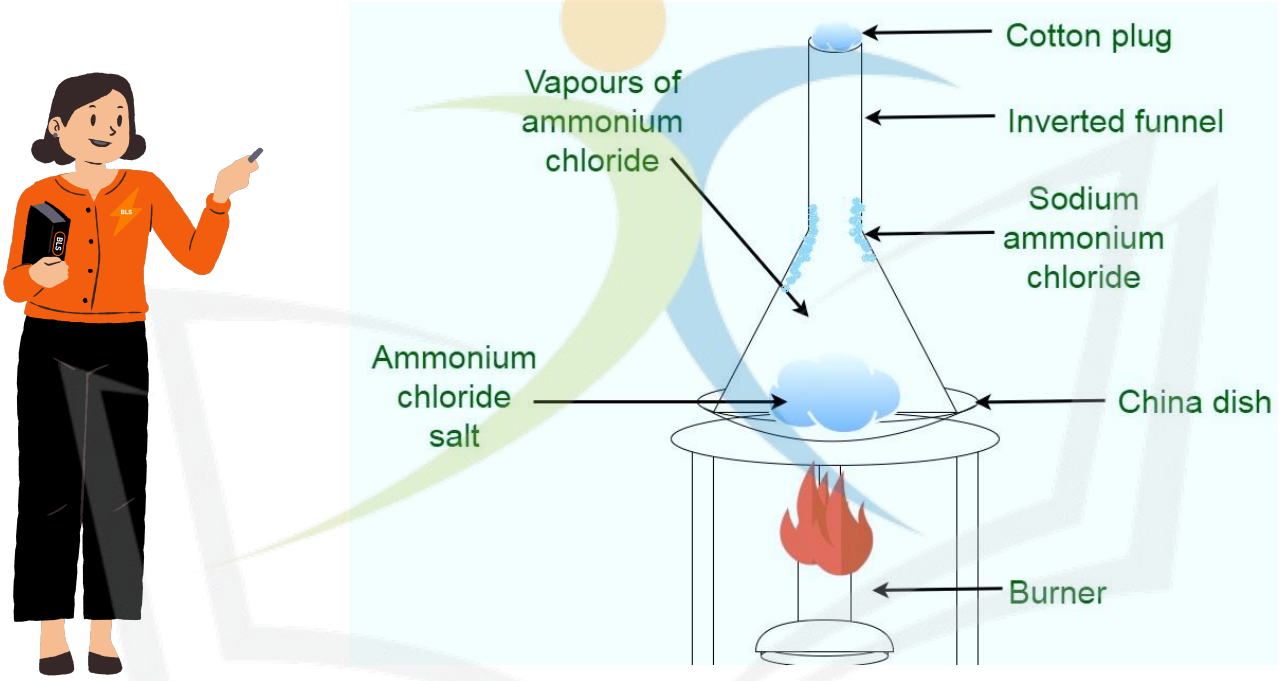
When we compress and decrease the temperature of a gas, the gas changes into a liquid.

Dry Ice

Carbon dioxide in solid form is known as Dry Ice. It can directly turn into a gas by decreasing the pressure to 1 atmosphere.

Sublimation

The transition of a substance directly from its solid phase to gaseous phase without changing into the liquid phase (or vice versa) is called sublimation.



Sublimation – Solid to Gas Phase Transformation

Atmospheric Pressure

The atmospheric pressure is equal to the pressure exerted by a mercury column of height "h". Atmospheric pressure = h × d × g, where h is the height of the mercury column, d the density of mercury and g the acceleration due to gravity. Atmospheric Pressure = h × d × g = 0.76 × 13600 × 9.8 = 101293 Pa.

LATENT HEAT

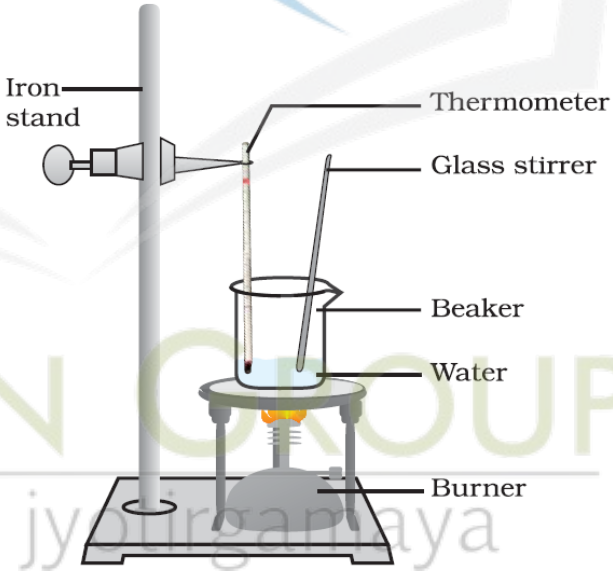
The heat energy which has to be supplied to change the state of a substance is called latent heat.

Latent heat does not raise the temperature. But the latent heat has always to be supplied to change the state of a substance. It is called latent heat because it becomes hidden in the substance undergoing the change of state and does not show its presence by raising the temperature. The latent heat which we supply is used up in overcoming the forces of attraction between the particles of a substance during the change of state.

The latent heat does not increase the kinetic energy of the particles of the substance. And since there is no increase in the kinetic energy of the particles, the temperature of a substance does not rise during the change of state.

Latent Heat of Fusion

The latent heat of fusion or melting of solid is the quantity of heat in joules required to convert 1 kg of solid to liquid, without any change in temperature.



The latent heat of fusion of ice is 3.34 ⨯ 105/kg.

We take some crushed ice in a beaker and suspend a thermometer in it. We note the temperature of ice. It is found to be 0. We now heat the ice gently by using a small flame of a burner. On heating, ice starts melting to form water. We keep on recording the temperature of melting ice on the thermometer every minute. As more heat is given, more ice melts to form water but the thermometer reading remains 0. As long as there remains even a little of ice in the beaker, the thermometer does not rise, it remains constant at 0.This shows that there is no rise in temperature

during the melting of ice. It is only when all the ice has melted that the temperature of water starts rising on further heating. The heat which is going into ice but not increasing its temperature, is the energy required to change the state of ice from solid to liquid.

Ice has strong inter particle forces of attraction. The heat which we supply to ice during melting is used up to overcome the forces of attraction so that they become somewhat loose. This heat does increases kinetic energy of particles and hence no rise in temperature take place. But when all the ice has melted to form water, further heating increases the kinetic energy of particles due to which the temperature increases.

Latent heat of Vaporisation

It is the quantity of heat in joules required to convert 1 kg of liquid to vapour or gas, without any change in temperature.

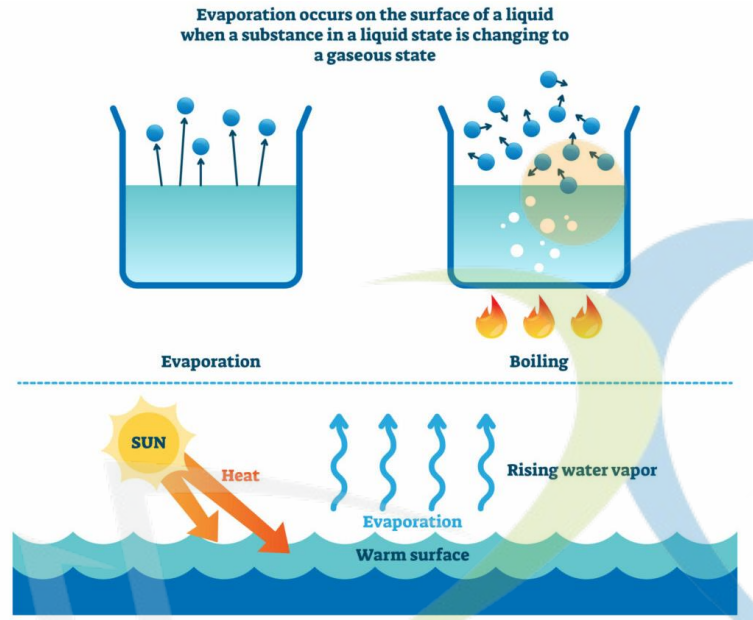
For Example: latent heat of vaporisation of water is 22.5 × 105 J/Kg

Take some water in a beaker and suspend a thermometer in it. We heat this water by using a small burner and note its temperature after every minute. As heat is given, the temperature of water rises gradually until 100 is reached. At the temperature of 100 water boils and start changing into steam. As more heat is given to water, more steam is formed but the thermometer reading remains at 100 showing that there is no rise in temperature during the boiling water. Thus, once the water begun to boil, the temperature remains constant at 100 until all the water has changed into steam. The heat which is going into boiling water but not increasing its temperature is the energy required to change the state of water from liquid to gas.

Particles of water attract each other. The heat energy which we supply during boiling is used to overcome forces of attraction between water particles so that they become totally free and change into a gas. This latent heat does not increase the kinetic energy and hence no rise in temperature take place.

EVAPORATION

The phenomenon by which molecules in liquid state undergo a spontaneous transition to the gaseous phase at any temperature below its boiling point is called evaporation.



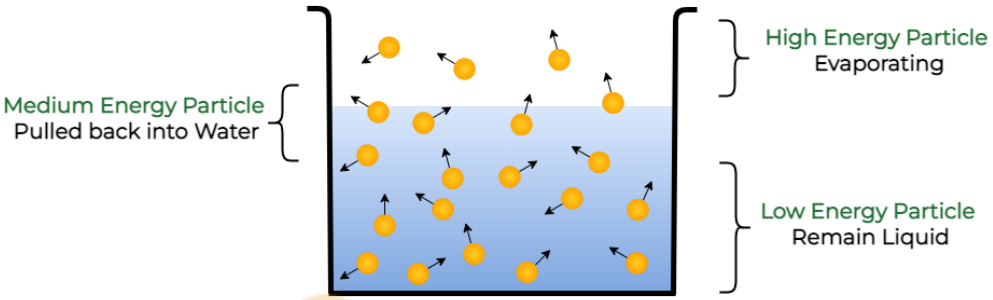
For example, the gradual drying of damp clothes is caused by the evaporation of water-to-water vapour.

Factors Affecting Evaporation

Condition	Rate of Evaporation	Reason
Increase in Surface Area	Increases	Particles have more space and thus can evaporate easily
Increase in temperature	Increases	Kinetic energy among the particles increases
Increase in humidity	Decreases	Water content in air increases and so evaporation decreases
Increase in wind speed	Increases	Water vapours are blown away by winds allowing more evaporation

Evaporation Causing Cooling Effect

The process of evaporation uses the energy of the liquid particles. Therefore, the particles absorb energy from the surroundings in order to compensate for the energy that is being lost in the process of evaporation. This results in the cooling of the surrounding area.



For Example:

- Our palms feel cool when we put some acetone (nail paint remover) on it.
- People sprinkle water on their roofs or ground on sunny days to cool the area.
- We are able to sip hot tea faster in a saucer than in a cup.

We wear cotton clothes in summer

We sweat more in summer. As the sweat evaporates it takes energy from our body surface and keeps our body cool. Cotton can absorb the sweat easily and exposes it to the atmosphere causing evaporation to take place easily. This, in turn, keeps us cool on summer days.

We see water droplets appear in the surroundings of glass with ice-cold water

There are water vapours present in the air. When they come in contact with the walls of the glass that has ice-cold water in it they condense. As a result, their state changes from the gaseous state to liquid state thus forming tiny water droplets on the walls of the glass.

Evaporation and Boiling

Evaporation	Boiling
Evaporation is a normal process that occurs when the liquid form changes into the gaseous form; while causing an increase in the pressure or temperature.	Boiling is an unnatural process where the liquid gets heated up and vaporized due to continuous heating of the liquid.
Evaporation usually occurs on the heated liquid's surface.	Boiling usually occurs on the entire mass of the liquid that gets heated up.
Bubbling effect is not visible in evaporation.	Bubbling effect is visible during the process of boiling.
The process of evaporation is slow.	The process of boiling is much quicker.

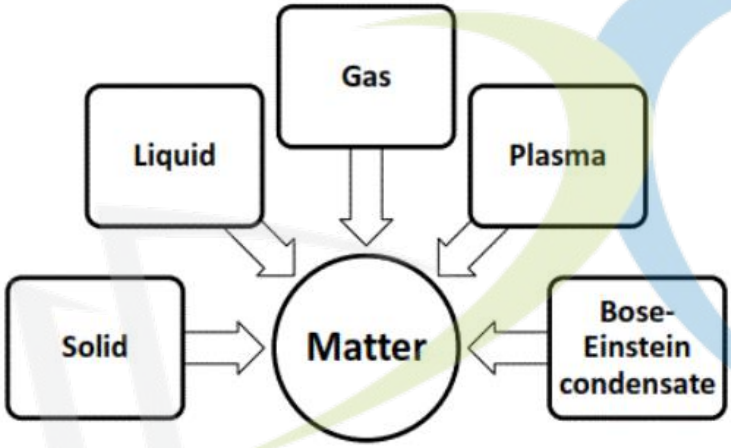
OTHER STATE OF MATTER

The Five States of Matter

By far we have discussed the three states of matter – Solid, Liquid, Gas.

But, scientists have discovered that there are two more states of matter –

- Plasma
- Bose-Einstein Condensate



Plasma

It is a state of matter in which the particles are super excited and super energetic. They are in the form of ionised gases.

For Example – Fluorescent tubes and neon light bulbs consist of plasma.

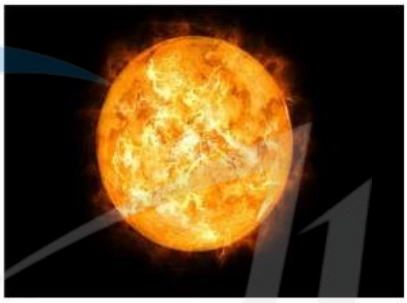
The neon bulbs contain neon gas and there is another gas such as helium in the fluorescent tube. As electricity is passed in the tube or the bulb, these gases get ionised and this creates the plasma inside them that glows.

In fact, the Sun and the stars glow because plasma is present in them. Here are some examples of Plasma:

Flames

Northern Lights

Lightning



The sun is an example of a star in the plasma state

Bose-Einstein Condensate (BEC)

It is the fifth state of matter discovered by Albert Einstein based on the studies conducted by an Indian scientist Satyendra Nath Bose.

BEC is formed by condensing gases of extremely low densities to much lower temperatures.

Important Measurement Units

SI Unit of Mass	Kg (Kilogram)
SI unit of Volume	m^3 (cubic metres)
Common unit of Volume	L (Litres)
SI unit of temperature	Kelvin 0O C = 273.16 K or 273 K (approximately) Kelvin = Celsius + 273
Si unit of Pressure	Pa (Pascal)
For measuring the pressure exerted by Gas	Atmosphere (atm) 1 atm = 1.01 × 105 Pa Normal Atmospheric Pressure = 1 atm (at sea level)

Matter in Our Surroundings

DPP-01

[Topic: Characteristics of Particles of Matter]

Very Short Answer Type Questions

1. Give reasons for the following observation:
   The smell of hot sizzling food reaches you several metres away, but to get the smell from cold food you have to go close.
2. A diver is able to cut through water in a swimming pool. Which property of matter does this observation show?
3. A substance has no mass, can we consider it as matter?
4. Why is light not considered as a form of matter?
5. Is smell of clove or cardamom (Elaichi) a form of matter?
6. What is the effect of temperature on the rate of diffusion?
7. Which term is used to describe the mixing of copper sulphate and water in a beaker?
8. Even two or three crystals of $KMnO_4$ (potassium permanganate) can impart colour to a very large volume of water. Which characteristic property of the particles of matter is illustrated here?
9. A piece of chalk can be broken easily but iron cannot, why?
10. What name is given to the particles of matter?

Short Answer Type Questions

11. Which of the following are matter?
    Chair, air, love, smell, hate, almonds, thought, cold, cold-drink, smell of perfume.
12. What are the characteristics of the particles of matter?
13. (i) When common salt is dissolved in water, what will be the change in volume and why?
    (ii) Write one similarity between the three states of matter.
14. Can solid diffuse in solids? Give an example.

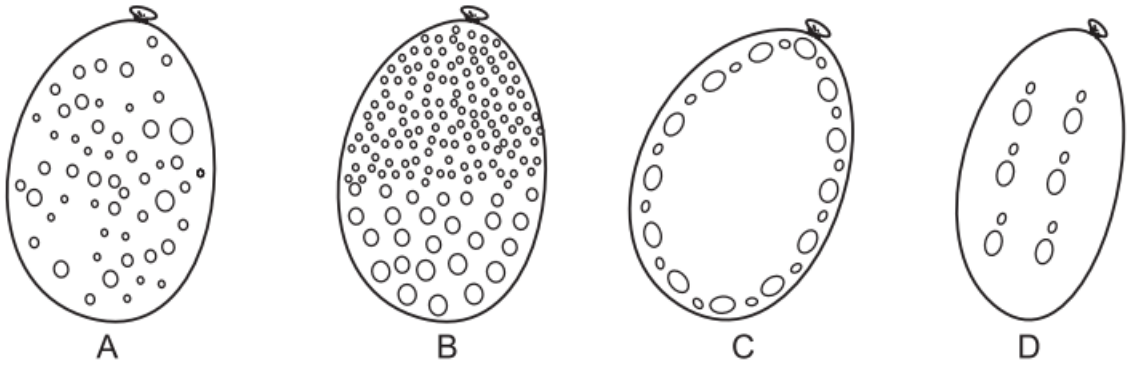
Matter in Our Surroundings

DPP-02

[Topic: Physical States of Matter]

Very Short Answer Type Questions

1. What is physical state of water at: (a) $250°C$, $(b) 100°C$?
2. Rubber band changes its shape. Is it a solid?
3. Name the property of gases due to which it is possible to fill CNG in cylinders for using as a fuel in car.
4. The melting point of these solids X, Y and Z are $298\ K, 314\ K$ and $398\ K$, respectively. Arrange these in increasing order of their interparticle forces of attraction.
5. How do we liquify the gases?
6. Which gas is supplied in liquified form: (i) at home, (ii) in hospitals.
7. Compare the forces of attraction between iron, rubber band and chalk.
8. Arrange sugar, water and oxygen in increasing order of forces of attraction between their particles.
9. Which diagram shows the arrangement of particles inside the balloon filled with a mixture of hydrogen and bromine?



Short Answer Type Questions

10. The mass per unit volume of a substance is called density. (density = mass/volume). Arrange the following in order of increasing density - air, exhaust from chimneys, honey, water, chalk, cotton and iron.
11. Give reasons for the following:
    (i) A gas completely fills the vessel in which it is kept.
    (ii) A gas exerts pressure on the walls of the container.
    (iii) A wooden table should be called a solid.
    (iv) We can easily move our hand in air but to do the same through a solid block of wood we need a karate expert.

12. Liquids generally have lower density as compared to solids. But you must have observed that ice floats on water. Find out why?
13. What is the full form of CNG? Mention its one property that makes it so important?
14. Sponge is a solid but still it can be compressed, why?
15. Among solids, liquids and gases which one has:
    (i) Maximum forces of attraction between particles.
    (ii) Maximum space in between the particles.
    Give reason in support of your answer.
16. What is tincture of iodine? Identify solute and solvent in it.
17. Ice, water and steam are three states of a substance and not different substances. Justify.
18. Arrange the three states of matter in the increasing order of:
    (i) rate of diffusion, (ii) motion of particles.
19. Why is iron almirah solid at room temperature? Give two reasons.
20. Cotton being a solid, floats on water, why?
21. Diffusion of a gas in water is essential. Explain.
22. Classify the following substances present in our body into solids, liquids and gases: Bones, Blood, Teeth, Air in Lungs, Water
23. What is meant by pressure of gas?
    OR
    Why do gas exert pressure?
24. Write the characteristic responsible for:
    (i) Smell of perfume spreads in the room.
    (ii) Water takes the shape of the container in which it is kept.
25. What will happen if inflated balloon is kept in a fridge and why?

Long Answer Type Question

26. (i) Tabulate the differences in the characteristics of states of matter.
    (ii) Comment upon the following: rigidity, compressibility, fluidity, filling a gas container, shape, kinetic energy and density.

Matter in Our Surroundings

DPP-03

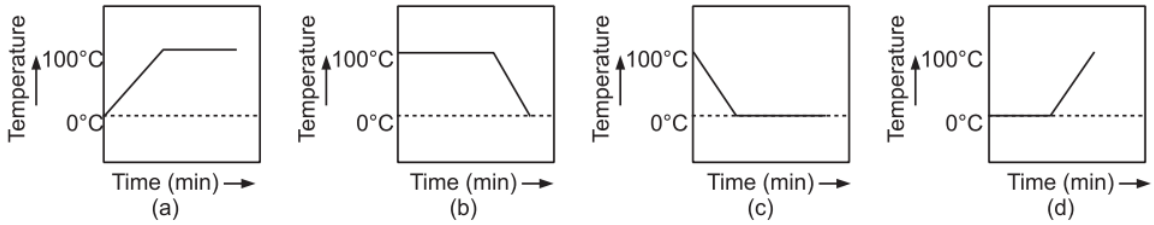
[Topic: Changes in States of Matter]

Very Short Answer Type Questions

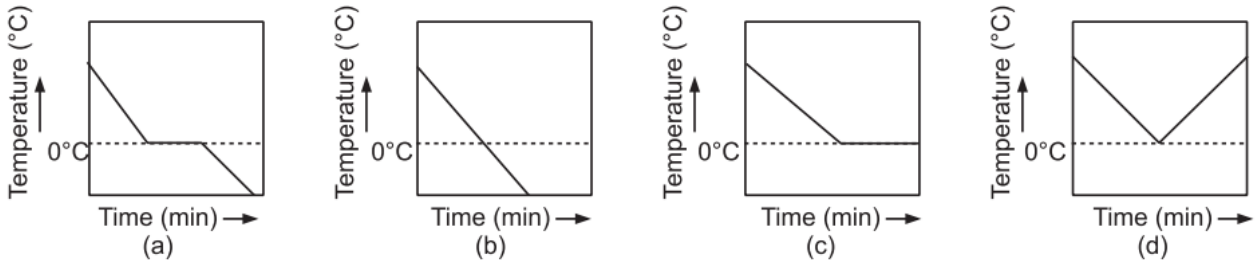
1. What is the melting point of ice?
2. Boiling point of alcohol is 78°C. Change it into kelvin scale of temperature.
3. Which has more density: liquids or solids?
4. Why solid carbon dioxide is called dry ice?
5. Why do we keep ether and acetone at cool places?
6. Under what conditions natural gas can be liquified?
7. The property to flow is unique to fluids. Which one of the following statements is correct?
   (i) Only gases behave like fluids
   (ii) Gases and solids behave like fluids
   (iii) Gases and liquids behave like fluids
   (iv) Only liquids behave like fluids
8. During summer, water kept in an earthen pot becomes cool because of the phenomenon of
   (i) diffusion
   (ii) transpiration
   (iii) osmosis
   (iv) evaporation
9. Few substances are arranged in the increasing order of 'forces of attraction' between their particles. Which one of the following represents a correct arrangement?
   (i) Water, air, wind
   (ii) Air, sugar, oil
   (iii) Oxygen, water, sugar
   (iv) Salt, juice, air
10. Which condition out of the following will increase the rate of evaporation of water?
    (i) Increase in temperature of water
    (ii) Decrease in temperature of water
    (iii) Less exposed surface area of water
    (iv) Adding common salt to water
11. In which of the following conditions, the distance between the molecules of hydrogen gas would increase?
    (i) Increasing the pressure on hydrogen gas contained in a closed container
    (ii) Some hydrogen gas leaking out of the container
    (iii) Increasing the volume of the container of hydrogen gas
    (iv) Adding more hydrogen gas to the container without increasing the volume of the container
    (a) (i) and (iii)
    (b) (i) and (iv)

(c) (ii) and (iii)
(d) (ii) and (iv)

12. A student heats a beaker containing ice and water. He measures the temperature of the content of the beaker as a function of time. Which of the following would correctly represent the result? Justify your choice.



13. Alka was making tea in a kettle. Suddenly she felt intense heat from the puff of steam gushing out of the spout of the kettle. She wondered whether the temperature of the steam was higher than that of the water boiling in the kettle. Comment.
14. A glass tumbler containing hot water is kept in the freezer compartment of a refrigerator (temperature $< 0°C$). If you could measure the temperature of the content of the tumbler, which of the following graphs would correctly represent the change in its temperature as a function of time.

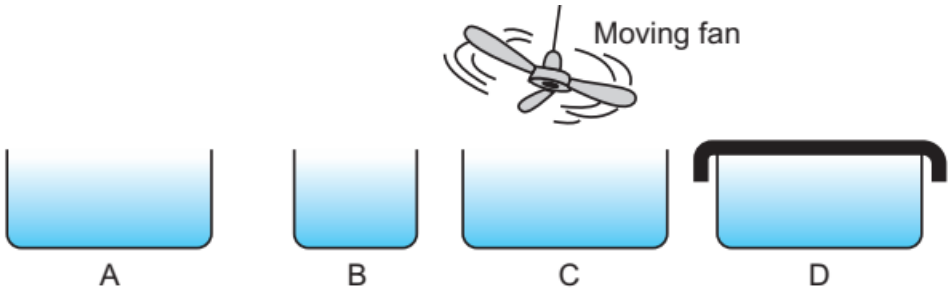


15. Explain how camphor disappears without leaving reside?
16. On a hot humid day, why do people sweat a lot?
17. (i) Convert 574 K to Celsius scale.
    (ii) What will be state of water at: (a) $108°C$
    (b) 275 K
    (c) 370 K
    (iii) Give reason why water at room temperature is liquid.

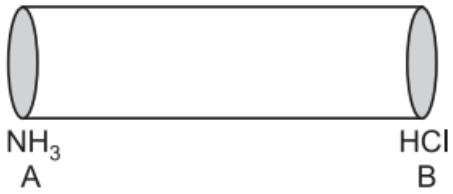
Short Answer Type Questions

18. (i) Give common properties of gases and liquids.
    (ii) Give one property common to all states of matter.
19. Name two factors which increases the rate of evaporation.
20. (i) Why do we wear cotton clothes in summers?
    (ii) Why do we feel cold, when we keep acetone and ether on our palm?
21. A sample of water under study was found to boil at $102°C$ at normal atmospheric pressure. Is the water pure? Will this water freeze at $0°C$? Comment.

22. Water as ice has a cooling effect, whereas water as steam may cause severe burns. Explain these observations.
23. Look at the figures given below. and suggest in which of the vessels A, B, C or D the rate of evaporation will be the highest? Explain.



24. You want to wear your favourite shirt for a party, but the problem is that it is still wet after a wash. What steps would you take to dry it faster?
25. Change the following temperature(s) into kelvin:
    (a) $-273^{\circ}\mathrm{C}$
    (b) $-100^{\circ}\mathrm{C}$
    $(c)-40^{\circ}\mathrm{C}(d)+30^{\circ}\mathrm{C}$
26. Give two reasons to justify that water is liquid.
27. Differentiate between evaporation and boiling.
28. Particles in liquid and gases show random motion. What does it mean and why does it occur?
29. Ammonia is absorbed on cotton on end ' A ' whereas HCl is absorbed by cotton at ' B ' end of the hollow tube. Where will they meet to form the white ring and why?
    [Molecular weight of $\mathrm{NH}_3=17u, \mathrm{HCl}=36.5u$]



Short Answer Type Questions-II

30. Define boiling point, melting point and evaporation.
31. Substance 1 is brittle, Substance 2 melts at $5^{\circ}\mathrm{C}$ and boils at $150^{\circ}\mathrm{C}$, Substance 3 has high melting point of $800^{\circ}\mathrm{C}$. What is the state of these substances at room temperature and pressure? Give reason.
32. Name the phenomenon which occurs in the following processes:
    (i) Formation of clouds
    (ii) Drying of wet clothes
    (iii) Wax melting in sun
33. Describe an activity to show particles have space among them.
34. Describe an activity to show that air contains water vapours.

35. With the help of an activity show that diffusion becomes faster with increase in temperature.
36. With the help of an activity show that gases are more easily compressible than liquids and solids.
37. Show by an activity that rate of intermixing of particles depends upon the forces of attraction between them.
38. Give reasons for the following:
    (i) Why does ice float on water?
    (ii) Why does a gas fill completely in the vessel in which it is kept?
    (iii) Latent heat of vapourisation of two liquids ' A ' and ' B ' is 100 and 150 J/Kg. Which one will produce more cooling effect and why?
39. (i) What is meant by the word 'Latent' in latent heat?
    (ii) Explain with the help of water:
    (a) latent heat of fusion, and
    (b) latent heat of vapourisation.
40. Describe an activity to determine the boiling point of water and melting point of ice.
41. What is meant by plasma? Explain.
42. How are Bose-Einstein Condensate (BEC) formed?

01

MATTER IN OUR SURROUNDINGS

INTRODUCTION

(Practice Sheet)

1 **Matter can be classified into three forms based on interparticle forces and arrangement. What are these forms?**

A. Liquid, gas, plasma
B. Solid, liquid, gas
C. Solid, gas, energy
D. Liquid, energy, gas

2 **According to early Indian philosophers, what are the five basic elements constituting matter?**

A. Air, water, earth, sky, and fire
B. Oxygen, hydrogen, carbon, nitrogen, and helium
C. Metal, wood, plastic, glass, and paper
D. Sun, moon, stars, planets, and galaxies

3 **What is the primary characteristic of matter's particles according to their physical nature?**

A. They are immobile
B. They are indivisible
C. They are particulate
D. They are transparent

4 **What characteristic is responsible for the solubility of substances in other substances?**

A. Continuous motion of particles
B. Attraction between particles
C. Voids between particles
D. Indivisibility of particles

5 **The continuous random movements of particles in matter are a result of:**

A. Magnetic forces
B. Electric charges
C. Kinetic energy
D. Gravitational pull

6 What is diffusion how it is affected by temperature?

7 Why do substances dissolve in each other?

8 What are the 4 states of substance?

9 What is the particulate nature of matter and define its Characteristics?

10 Diffusion of gases in water is essential. Explain the term with suitable example.

(Practice Sheet)

1 **What is a characteristic property of solids that differentiates them from liquids and gases?**

A. Fluidity
B. Rigid structure
C. Compressibility
D. High thermal expansion

2 **Which state of matter has molecules with the least compressibility and thermal expansion?**

A. Solids
B. Liquids
C. Gases
D. Plasma

3 **What property allows liquids to acquire the shape of a vessel?**

A. Rigidity
B. Fluidity
C. Compressibility
D. Thermal expansion

4 **What is the intermolecular distance range in gases?**

A. $10^{-9} – 10^{-7}$ cm
B. $10^{-8} – 10^{-6}$ cm
C. $10^{-7} – 10^{-5}$ cm
D. $10^{-6} – 10^{-4}$ cm

5 **What is the arrangement of molecules in liquids compared to solids?**

A. Regular and closely arranged
B. Random and little sparsely arranged
C. Random and more sparsely arranged
D. Fixed and orderly arranged

6 How is matter classified on the basis of physical state?

7 Draw a cyclic figure to show interconversion of states and explain fusion, vaporisation, condensation, solidification and sublimation.

8 What is the fluidity of the state of matter?

9 What happens to the density of a substance as it changes from a solid to a liquid and then to a gas?

10 Explain the concept of thermal expansion and how it varies in solids, liquids, and gases.

(Practice Sheet)

1 **What happens to the kinetic energy of matter particles as temperature rises?**

A. Decreases **B.** Remains constant

C. Increases **D.** Reverses direction

2 **What is the transformation from a solid to a liquid called?**

A. Condensation **B.** Melting

C. Boiling **D.** Freezing

3 **Which scale is based on 0°C for the freezing point and 100°C for the boiling point of water?**

A. Kelvin Scale **B.** Fahrenheit Scale

C. Celsius Scale **D.** Absolute Scale

4 **What happens to particles in a gas when condensation occurs?**

A. They stop moving **B.** They become free and fast-moving

C. They vibrate at a higher frequency **D.** They solidify

5 **What is the unit of the Kelvin or thermodynamic temperature scale?**

A. Fahrenheit **B.** Celsius

C. Kelvin **D.** Centigrade

6 Explain how an increase in temperature affects the interparticle force of attraction in matter.

7 What is the significance of the boiling point in the change of state of matter?

8 Explain the concept of condensation and provide Example?

9 Compare the Celsius, Kelvin, and Fahrenheit temperature scales, highlighting their reference points.

10 Explain the concept of atmospheric pressure and its calculation.

01

MATTER IN OUR SURROUNDINGS

LATENT HEAT

(Practice Sheet)

1 **What is latent heat?**

A. Heat that raises the temperature
B. Hidden heat during state change
C. Heat that increases kinetic energy
D. Heat involved in phase transitions

2 **Why is latent heat called "latent"?**

A. It remains constant
B. It becomes hidden during phase change
C. It is not measurable
D. It is hard to detect

3 **What does latent heat of fusion refer to?**

A. Heat required for boiling
B. Heat required for melting
C. Heat involved in kinetic energy
D. Heat causing a rise in temperature

4 **What is the latent heat of fusion for ice?**

A. 2.25×10^5 J/kg
B. 3.34×10^5 J/kg
C. 1.5×10^5 J/kg
D. 4.5×10^5 J/kg

5 **What is the latent heat of vaporization?**

A. Heat required for melting
B. Heat required for boiling
C. Heat involved in kinetic energy
D. Sensible heat

6 Explain the concept of latent heat and why it is considered "hidden" during a change of state.

7 Differentiate between latent heat of fusion and latent heat of vaporization.

8 Why is latent heat crucial for phase transitions, and how does it differ from sensible heat?

9 How does latent heat contribute to the concept that temperature does not rise during a change of state?

10 How does latent heat of vaporization contribute to the conversion of a liquid into a gas, and why does the temperature remain constant during this phase change?

(Practice Sheet)

1 **What is the phenomenon by which molecules in a liquid state transition to the gaseous phase below the boiling point called?**

A. Condensation **B.** Evaporation

C. Boiling **D.** Sublimation

2 **What factor increases the rate of evaporation by providing particles with more space to evaporate easily?**

A. Increase in humidity **B.** Increase in wind speed

C. Increase in surface area **D.** Increase in temperature

3 **Which of the following substances can cause a cooling effect due to evaporation?**

A. Ice **B.** Acetone (nail paint remover)

C. Hot tea **D.** Cotton clothes

4 **Why do people sprinkle water on roofs or ground on sunny days?**

A. To increase humidity **B.** To reduce wind speed

C. To decrease evaporation **D.** To cool the area through evaporation

5 **What happens to our body when we sweat in summer, and why do we wear cotton clothes in hot weather?**

A. Body heats up; to increase insulation **B.** Body cools down; to enhance evaporation

C. Body remains constant; for fashion **D.** Body dehydrates; for comfort

6 Explain the concept of evaporation and provide an example from daily life.

7 How does evaporation cause a cooling effect in the surroundings?

8 We should wear cotton clothes in hot summer days to keep cool and comfortable. Why?

9 Describe the process of condensation and provide an example of its occurrence.

10 When comparing evaporation and boiling What are the two differences in these changes in state of matter?

(Practice Sheet)

1 **What are the two additional states of matter mentioned?**

A. Liquid and solid
B. Plasma and Bose-Einstein Condensate
C. Gas and plasma
D. Solid and Bose-Einstein Condensate

2 **In which state of matter are particles super excited and super energetic, forming ionized gases?**

A. Solid
B. Liquid
C. Gas
D. Plasma

3 **What is an example of a device that consists of plasma?**

A. Refrigerator
B. Microwave
C. Fluorescent tube
D. Oven

4 **How is Bose-Einstein Condensate formed?**

A. By heating gases
B. By cooling gases to extremely low temperatures
C. By compressing gases
D. By ionizing gases

5 **What is the SI unit of temperature?**

A. Celsius
B. Kelvin
C. Pascal
D. Atmosphere

6 Describe how Bose-Einstein Condensate (BEC) is formed and who played a crucial role in its discovery.

7 Why do the Sun and stars glow, and in which state of matter is this phenomenon observed?

8 What are the important measurement units for mass, volume, temperature, and pressure in the SI system?

9 Explain the concept of normal atmospheric pressure and its unit of measurement.

10 Explain the characteristics of the state of matter known as "plasma" and provide examples of where it is found.

EXEMPLAR SOLUTION

Chapter 1
Matter in our surrounding

Multiple Choice Questions

1. Which one of the following sets of phenomena would increase on raising the temperature?

(a) Diffusion, evaporation, compression of gases

(b) Evaporation, compression of gases, solubility

(c) Evaporation, diffusion, expansion of gases

(d) Evaporation, solubility, diffusion, compression of gases

Soln:

Answer is c) Evaporation, diffusion and expansion of gases

Explanation:

Particles of matter are continuously moving as they possess kinetic energy. When temperature us raised particles of matter intermix with each other which is called diffusion.

Evaporation means conversion of liquid state into vapour state. When we increase temperature molecules move and vibrate so quickly that they escape into the atmosphere in the form of vapours.

Increase in temperature causes the molecules move faster this results in expansion of gases.

2. Seema visited a Natural Gas Compressing Unit and found that the gas can be liquefied under specific conditions of temperature and pressure. While sharing her experience with friends she got confused. Help her to identify the correct set of conditions

(a) Low temperature, low pressure

(b) High temperature, low pressure

(c) Low temperature, high pressure

(d) High temperature, high pressure

Soln:

Answer is c) Low temperature, high pressure

Explanation:

To compress gas into liquid, low temperature and high pressure is required. Between the particles of gas there is lot of space. On applying pressure particles get closer and they start attracting each other to form a liquid. Lot of heat is generated when gas is compresses hence it is necessary to cool it. Cooling lowers the temperature of compressed gas and helps in liquefying it.

3. The property to flow
is unique to fluids. Which one of the following statements is correct?

(a) Only gases behave like fluids

(b) Gases and solids behave like fluids

(c) Gases and liquids behave like fluids

(d) Only liquids are fluids

Soln:

Answer is c) Gases and liquids behave like fluids

Explanation:

In gases and liquids intermolecular force of attraction between the particles is less and they facilitate flow of these states of matter.

4. During summer, water kept in an earthen pot becomes cool because of the phenomenon of

(a) diffusion

(b) transpiration

(c) osmosis

(d) evaporation

Soln:

Answer is d) evaporation

Explanation:

Evaporation of water through pores of earthen pot reduces temperature of immediate surroundings. This makes the water cool after some time.

Movement of water through plants and evaporation through its aerial parts is called tyranspiration.

Diffusion is the movement of a substance from an area of higher concentration to area of lower concentration

If molecules of a solvent tend to pass through a semipermeable membrane from a less concentrated solution into a more concentrated one it is called osmosis.

5. A few substances are arranged in the increasing order of 'forces of attraction' between their particles. Which one of the following represents a correct arrangement?

(a) Water, air, wind

(b) Air, sugar, oil

(c) Oxygen, water, sugar

(d) Salt, juice, air

Soln:

Answer is c) Oxygen, water, sugar

Explanation:

Intermolecular force of attraction is less in gases than liquid and solid. Solids have higher intermolecular attraction compared to liquid. In the answer Oxygen is a gas which has lesser intermolecular attraction than water-a liquid and sugar- a crystalline solid.

6. On converting 25°C, 38°C and 66°C to kelvin scale, the correct sequence of temperature will be

(a) 298 K, 311 K and 339 K

(b) 298 K, 300 K and 338 K

(c) 273 K, 278 K and 543 K

(d) 298 K, 310 K and 338 K

Soln:

Answer is a) 298 K, 311 K and 339 K

Explanation:

Add 273 to respective temperature to get temperature in kelvin. 25°-298K, 38°-311K, 66°-339K

7. Choose the correct statement of the following

(a) Conversion of solid into vapours without passing through the liquid state is called sublimation.

(b) Conversion of vapours into solid without passing through the liquid state is called vaporisation.

(c) Conversion of vapours into solid without passing through the liquid state is called freezing.

(d) Conversion of solid into liquid is called sublimation.

Soln:

Answer is a) Conversion of solid into vapours without passing through the liquid state is called sublimation.

Explanation:

- Sublimations is a process in which a solid is converted into vapours without passing through liquid state.
- Vaporisation is a phase transition from liquid to vapours.
- Conversion of liquid to solid at substance's freezing temperature is called as freezing.

8. The boiling points of diethyl ether, acetone and n-butyl alcohol are 35°C, 56°C and 118°C respectively. Which one of the following correctly represents their boiling points in kelvin scale?

(a) 306 K, 329 K, 391 K

(b) 308 K, 329 K, 392 K

(c) 308 K, 329 K, 391 K

(d) 329 K, 392 K, 308 K

Soln:

Answer is c) 308 K, 329 K, 391 K

Explanation:

Temperature in Celsius can be converted into temperature in kelvin by adding 273 to the Celsius value. Boiling points of diethyl ether, acetone and n-butyl alcohol are 308 K, 329 K, and 391 K respectively.

9. Which condition out of the following will increase the evaporation of water?

(a) Increase in temperature of water

(b) Decrease in temperature of water

(c) Less exposed surface area of water

(d) Adding common salt to water

Soln:

Answer is a) Increase in temperature of water

Explanation:

Increase in temperature of water increase the kinetic energy of the water which will make more particles to attain enough energy to convert into vapour state. This is how increase in temperature favours evaporation.

On the other hand exposed surface is also responsible for the evaporation. Higher the exposed surface are higher will be the evaporation.

When common salt is added to water then surface is occupied by the solvent as well as non-volatile solute particles.
This make the escaping tendency of solvent particles decrease and thus the evaporation of water decreases.
Hence options (b), (c) and (d) will decrease the evaporation of water.

10. In which of the following conditions, the distance between the molecules of hydrogen gas would increase?

(i) Increasing pressure on hydrogen contained in a closed container

(ii) Some hydrogen gas leaking out of the container

(iii) Increasing the volume of the container of hydrogen gas

(iv)Adding more hydrogen gas to the container without increasing the volume of the container

(a) (i) and (iii)

(b) (i) and (iv)

(c) (ii) and (iii)

(d) (ii) and (iv)

Soln:

Answer is c) ii and iii

Explanation

- To increase the intermolecular interaction either volume of Hydrogen gas should be reduced or container volume should be increase.
- By increasing the pressure or by adding Hydrogen without increasing container volume inter-molecular interaction would decrease.
- Water under study was found to boil at 102°C at normal temperature and pressure.

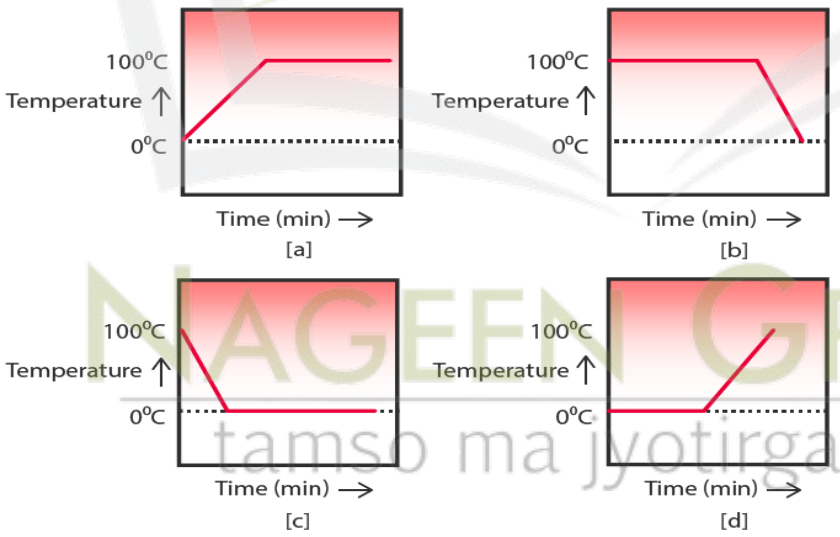
Short Answer Questions

11. A sample of water under study was found to boil at 102°C at normal temperature and pressure. Is the water pure? Will this water freeze at 0°C? Comment.

Soln:

Boiling point of pure water is 100 °C and melting point is 0°C at 1 atmospheric pressure. Here the water boils at 102 °C hence it is not a pure water and freezes at temperature below 0°C.

12. A student heats a beaker containing ice and water. He measures the temperature of the content of the beaker as a function of time. Which of the following (Fig. 1.1) would correctly represent the result? Justify your choice.



Soln:

Answer is d) because at the start of the experiment temperature of the mixture would be zero as water and ice will be in equilibrium. When students start heating initially latent heat will be utilised to melt the ice. Hence the temperature did not increase for certain amount of time. When students heat the mixture further the temperature of the water increases gradually.

13. Fill in the blanks:

(a) Evaporation of a liquid at room temperature leads to a——— effect.

(b) At room temperature the forces of attraction between the particles of solid substances are———than those which exist in the gaseous state.

(c) The arrangement of particles is less ordered in the ——— state. However, there is no order in the ——— state.

(d) ——— is the change of solid state directly to vapour state without going through the ———state.

(e) The phenomenon of change of a liquid into the gaseous state at any temperature below its boiling point is called———.

Soln:

a. Cooling
b. Stronger
c. Liquid, gaseous
d. Sublimation, liquid
e. Evaporation

14. Match the physical quantities given in column A to their S I units given in column B:

(A)	**(B)**
(a) Pressure	**(i) cubic metre**
(b) Temperature	**(ii) kilogram**
(c) Density	**(iii) pascal**
(d) Mass	**(iv) kelvin**
(e) Volume	**(v) kilogram per cubic metre**

Soln:

(a) — (iii) The SI unit of pressure is pastor (denoted by P).

(b) — (iv) The SI unit of temperature is -kelvin" (denoted by K).

(c) — (v) The SI unit of density is kilogram per cubic metre (kg/m3).

(d) — (if) The SI unit of mass is kilogram (kg).

(e) — (i) The SI unit of volume is m3.

15. The non S I and S I units of some physical quantities are given in column A and column B respectively. Match the units belonging to the same physical quantity:

(A)	(B)
(a) Degree Celsius	(i) kilogram
(b) Centimetre	(ii) Pascal
(c) Gram per centimetre cube	(iii) metre
(d) Bar	(IV) kelvin
(e) Milligram	(v) kilogram per metre cube

Soln:

(a) — (iv) Degree Celsius and kelvin are the units of temperature.

(b) — (iii) Centimetre and metre are the units of length.

(c)—(v) Gram per centimetre cube and kilogram per metre cube are the units of density.

(d) — (Ii) Bar and pascal are the units of pressure.

(e) - (i) Milligram and kilogram are the units of mass.

16. 'Osmosis is a special kind of diffusion'. Comment.

Soln:

Diffusion in liquids and gases is the movement of particles from low concentration to high concentration. Osmosis is the movement of particles from the low concentration to high concentration through the semi permeable membrane. This movement happens due to diffusion. Hence Osmosis is a special kind of diffusion.

17. Classify the following into osmosis/diffusion

(a) Swelling up of a raisin on keeping in water.

(b) Spreading of virus on sneezing.

(c) Earthworm dying on coming in contact with common salt.

(d) Shrinking of grapes kept in thick sugar syrup.

(e) Preserving pickles in salt.

(f) Spreading of smell of cake being baked throughout the house.

(g) Aquatic animals using oxygen dissolved in water during respiration

Soln:

a) Osmosis

b) Diffusion

c) Osmosis

d) Osmosis

e) Osmosis

f) Diffusion

g) Diffusion

Explanation:

a) Concentration of water will be more than water concentration in raisin. Hence there is a movement of water from higher concentration to lower concentration which will make the raisin swell up.

b) Microscopic virus get diffused in air.

c) Because of vary in concentration of water and solute. Water comes out of earthworm body making its cell to burst causing its death.

d) Thick sugar syrup has more solutes in it than grapes. Hence water moves out of the grapes from higher concentration to lower concentration hence grapes swell.

e) Salt helps to remove water from the cells and helps to preserve pickles. Pickling is intended to keep out oxygen. Pickling prevents oxidation of fruits and vegetables through the use of salt. Dry salt forms pickling brine and absorbs excess moisture from fruits and vegetables through the process of osmosis.

f) Particles containing smell diffuse into air to spread it throughout the house

g) When Aquatic animals breathe dissolved oxygen, oxygen diffuses directly into their blood without any membrane.

18. Water as ice has a cooling effect, whereas water as steam may cause severe burns. Explain these observations.

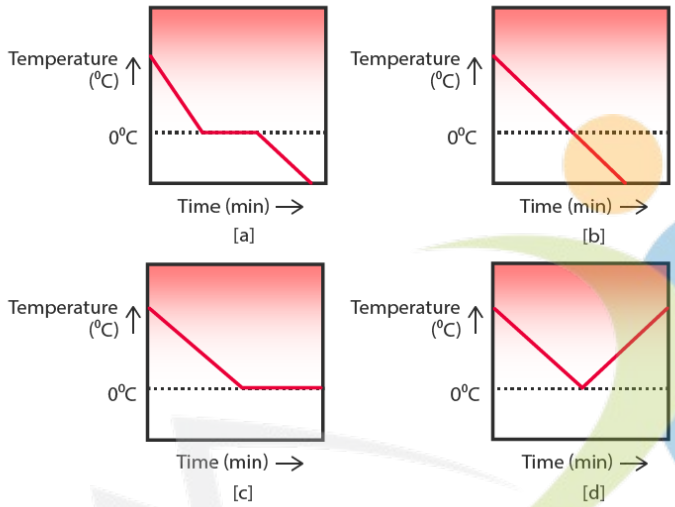
Soln:

Water as ice has less energy and water molecules absorb energy from our body to give cooling effect whereas steam has high energy and transfers high energy into our body which transforms as heat to cause burns.

19. Alka was making tea in a kettle. Suddenly she felt intense heat from the puff of steam gushing out of the spout of the kettle. She wondered whether the temperature of the steam was higher than that of the water boiling in the kettle. Comment.

Steam and the water temperature boiling in the kettle is the same. But the particles of steam have more energy in the form of latent heat of vaporisation than the particles of water. This energy is released when the steam condenses to water. Therefore, steam is hotter than the boiling water.

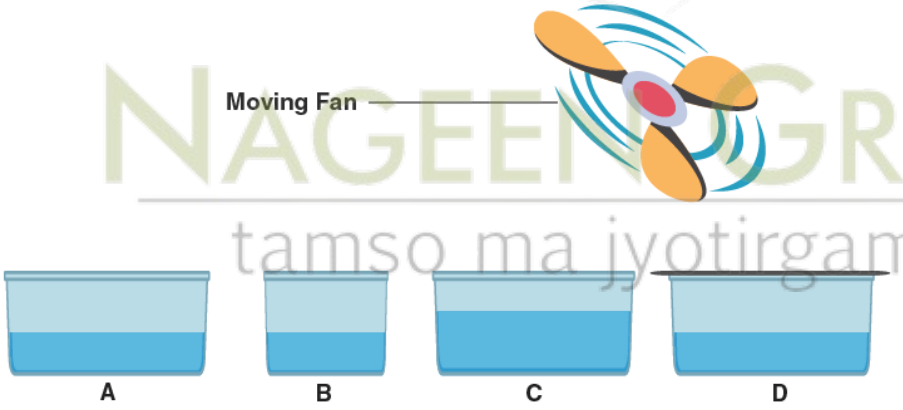
20. A glass tumbler containing hot water is kept in the freezer compartment of a refrigerator (temperature < 0°C). If you could measure the temperature of the content of the tumbler, which of the following graphs (Fig.1.2) would correctly represent the change in its temperature as a function of time.



Soln:

Graph (a) is the right answer because water will cool initially till its temperature reaches 0 °C. After reaching freezing point (0 °C) temperature will remain constant till the water becomes ice. After that point temperature would decrease again.

21. Look at Fig. 1.3 and suggest in which of the vessels A,B, C or D the rate of evaporation will be the highest? Explain.



Soln:

Answer is C because evaporation increases with increase in the surface area. With increase in wind speed particles of water vapour will move away hence the rate of evaporation will be the highest.

22.

(a) Conversion of solid to vapour is called sublimation. Name the term used to denote the conversion of vapour to solid.

(b) Conversion of solid state to liquid state is called fusion; what is meant by latent heat of fusion?

used to denote the conversion of vapour to solid.

Soln:

a) Sublimation is the term used to denote the conversion of vapour to solid.

b) The amount of heat energy released or absorbed when a solid changing to liquid at atmospheric pressure at its melting point is known as the latent heat of fusion.

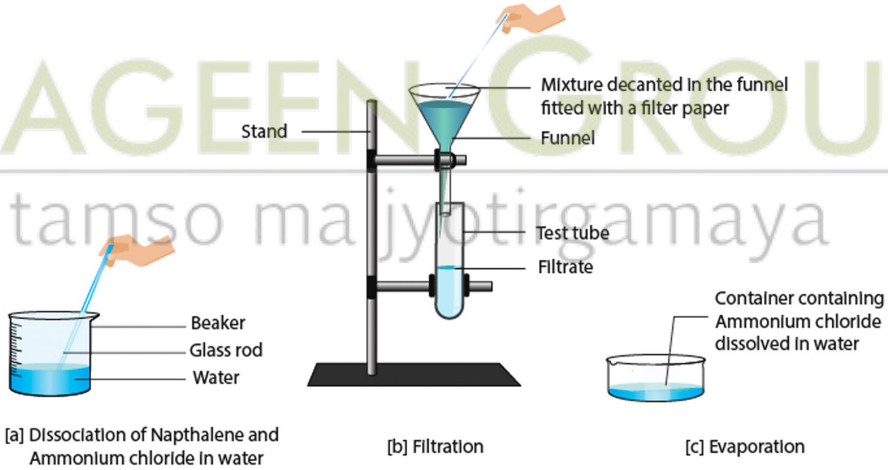
Long Answer Questions

23. You are provided with a mixture of naphthalene and ammonium chloride by your teacher. Suggest an activity to separate them with well labelled diagram.

Soln:

Naphthalene is a non-polar compound which will not dissolve in water. Similarly ammonium chloride is a polar compound which is soluble in water. Naphthalene is volatile in room temperature whereas ammonium chloride is volatile in high temperature.

The mixture of Naphthalene and ammonium chloride can be separated by decantation of aqueous mixture. Naphthalene remains undissolved in water and can be taken out in a funnel. The filtrate of ammonium chloride can be evaporated to obtain dry ammonium chloride.



[a] Dissociation of Napthalene and Ammonium chloride in water

[b] Filtration

[c] Evaporation

24. It is a hot summer day, Priyanshi and Ali are wearing cotton and nylon clothes respectively. Who do you think would be more comfortable and why?

Soln:

Hot summer leads to lot of sweating. Cotton absorbs lot of moisture whereas Nylon will not absorb the moisture as efficient as cotton. Hence cotton absorbs the sweat faster that Nylon does. Evaporation of moisture from the cotton cloth will give a cool feeling, especially when wind flows. Hence It can be concluded that Priyanshi will be more comfortable in summer days.

25. You want to wear your favourite shirt to a party, but the problem is that it is still wet after a wash. What steps would you take to dry it faster?

Soln:

Drying of clothes is due to process of evaporation hence following steps should be taken to dry the shirt faster.

1. Dry the shirt under fan with high speed. With increase in speed of fan water vapour move away with wind. This decreases water vapour in the surroundings which will increase the evaporation and the shirt gets dried faster.
2. Spread the shirt on a hanger which will increase surface area. Increase in surface area makes the shirt dry quickly.
3. Dry the shirt in sunlight. Because of high temperature more water vapour gets kinetic energy to get converted to vapour. This will fasten the process of evaporation and the shirt gets dried easily.
4. Iron the shirt. Heat increases the speed of vaporization and evaporation. This will make the shirt gets dried faster.

26. Comment on the following statements:

(a) Evaporation produces cooling.

(b) Rate of evaporation of an aqueous solution decreases with increase in humidity.

(c) Sponge though compressible is a solid.

Soln:

a) When liquid evaporates it takes latent heat from the object it touches. This will make the object gets cool. Hence evaporation causes cooling.

b) When there is increase in the humidity water vapours in the atmosphere will be more. Hence atmosphere will not take water vapours easily which decreases the process of evaporation.

c) Sponge is a solid because it has definite shape and volume which does not change until you press it. It has minute pores in which air is filled. When you press air passes out through pores this makes it a compressible solid.

27. Why does the temperature of a substance remain constant during its melting point or boiling point?

The temperature of a substance remains constant during melting and boiling points till the completion of melting and boiling because of latent heat of fusion used by the substances. Latent heat of fusion helps to overcome the force of attraction between particles of solid to change into liquid when they melt. Hence temperature remains constant.

I the same way during formation of vapours latent heat helps solid substance to convert into gaseous state. Hence temperature of a substance remain constant at boiling point.

Chapter 1
Matter in our Surroundings

Questions:

Q. 1 Which of the following are matters?

Chair, air, love, smell, hate, almonds, thought, cold, cold drink, smell of perfume.

Answer : Anything which occupies space and has mass is called matter.

There are three states of matter:- solid, liquid, gas.Chair, almonds: solid since they have definite shape and mass.

Cold drink: liquid since it has fixed volume.

Air, Smell of the perfume, smell: gas matter since they are gases.

The smell is a state of the matter since it is due to the presence of some vapour state substance in air which occupy space & have mass due to which there is smell.

Hence, Chair, Almonds, Cold drink, smell, the smell of perfume and Air are examples of the matter.

Q. 2 Give reasons for the following observations: The smell of hot sizzling food reaches you several meters away but to get the smell from cold food, you have to go close.

Ans.: The smell of hot sizzling food reaches you several meters away but to get the smell from cold food due to very high rate of diffusion of hot aroma particles of the food in the air as compared to the particles of cold food, due to the high speed of particles and large space between them,

gases show the property of diffusing very fast into other gases at high temperature as compare to low temperature.

Q.3 A diver is able to cut through water in a swimming pool. Which property of matter does this observation show?

Ans.: The diver is able to cut through water in a swimming pool because of the property of the matter have space between them.

Explanation:Water in the swimming pool is an example of the liquid state of matter, as a result, particles in the water move freely and have greater space between each other as compared to particles in the solid state. Thus, the diver is able to cut through the water in a swimming pool.

Q.4 What are the characteristics of the particles of matter?

Ans.: Anything which has mass and occupies space is called matter. The important characteristics of the particles of matter(atoms or molecules) are following:

(i) The particles of matter have spaces between them known as inter molecular space. Particles of one type of matter are able to get into the spaces of the particles of other. For example, when we dissolve salt or sugar in water, the particles of sugar or salt get evenly distributed in water.

(ii) The particles of matter are constantly moving as they possess kinetic energy. With the increase in temperature, particles move faster. As a result, the kinetic energy of the particles also increases.

(iii) The particles of matter attract each other. They have force of attraction acting between them. This force helps to keep the particles of matter together. The strength of this force of attraction depends on the nature of matter.This is known as inter molecular force of attraction

Questions:

Q.1 The mass per unit volume of a substance is called density (density = mass/ volume).

Arrange the following in order of increasing density:
Air, Exhaust from chimneys, Honey, Water, Chalk, Cotton and Iron
Ans.: Density is mainly determined by the intermolecular forces of attraction

Solids have high intermolecular forces of attraction, as a result, they have high density followed by liquids and gases which have less intermolecular forces of attraction. We can draw the following inference:-On the basis of the above information the order of increasing densities of the given substances is:

Air (gas) < Exhaust from chimneys (condense gas)< Cotton(light porous solid) < Water (liquid) < Honey(Thich liquid) < Chalk(heavy porous solid) < Iron(solid).

Q.2(A) Tabulate the differences in the characteristics of the three states of matter.

Ans.: The main differences in the characteristics of the three states of matter, solids, liquids and gases are given below:

Solids	Liquids	Gases
(i) Solids have distinct boundaries which helps them to maintain a fixed shape and volume.	(i) Liquids do not have distinct boundaries and have no fixed shape. Liquids have fixed volumes. They take the shape of the container in which they are placed.	(i) Gases have neither a fixed shape nor a fixed volume. They acquire the shape and volume of the container in which they are kept.
(ii) Solids cannot be compressed much. They have a tendency to maintain their shape when subjected to outside force. The forces of attraction between the particles are maximum.	(ii) Like solids, liquids cannot be compressed much. The forces of attraction between the particles are moderate.	(ii) Gases can be compressed easily (into a small volume). The force of attraction between the particles of gas are minimum as compared to solids and liquids.
(iii) Solids have high densities. They are densely packed.	(iii) Liquids have moderate to high densities. They are usually less dense than solids.	(iii) Gases have very low densities. A gas is much fighter than the same volume of a solid or a liquid.
(iv) Solids do not fill their container completely. The particles in solids are packed closely and are not able to move freely. They have fixed positions.	(iv) Liquids do not fill their container completely. The particles in liquids are moderately packed. They have a fixed volume.	(iv) Gases fill their container completely. The particles in a gas do not have fixed positions and are able to move freely. Because of weak forces of attraction among the particles,

		they do not have fixed volumes. As a result, gases fill their container completely.
(v) Solids do not flow because they have rigid boundaries.	(v) Liquids generally flow easily because they are not rigid and take the shape of the container in which they are kept.	(v) Gases flow easily. They do not have rigid shape and fixed volume.

Q.2(B) Comment upon the following:

Rigidity, Compressibility, Fluidity, Filling a gas container, Shape, Kinetic energy and Density.

Ans.:

(i) Rigidity

Property of the Substance to retain/maintain their shape when subjected to outside force is known as rigidity.

This property is determined by the inter molecular force of attraction.

(ii) Compressibility

The particles of matter have intermolecular spaces. If an external force is applied, it can bring these particles closer.

The property of a fluid or a solid due to which its volume decreases when pressure is applied is called Compressibility.

Gases have high compressibility because they have a lot of inter molecular spaces.

The particles in solids and liquids are closely packed, so solids and liquids do not have much compressibility.

(iii) Fluidity

The tendency of the particles to flow is known as its fluidity.

Gases and liquids exhibit the property of fluidity, so they are called fluids.

This property is determined by intermolecular force of attraction as well as intermolecular spaces.

Due to large intermolecular spaces and very weak forces of attraction, gases can flow very easily followed by liquids and then solids which have almost negligible fluidity.

(iv) Filling a gas container

A gas is able to fill the container because its particles are able to vibrate randomly in all the directions.

The particles of gas have very high kinetic energy and almost negligible forces of attraction.

As a result, gases are able to fill the container fully.

(v) Shape

The external form or appearance of a substance is called its Shape.

The particles in a solid have very strong forces of attraction due to which they are closely packed so they have a fixed shape.

The liquids and gases have comparatively weaker forces of attraction between them as a result they take the shape of container in which they are stored.

(vi) Kinetic energy

The energy possessed by particles due to their motion is called kinetic energy.

At a given temperature, the particles of gas have the maximum kinetic energy.

Liquids have lesser kinetic energy as compared to gases whereas solids have the least kinetic energy at a given temperature.

(vii) Density

The mass per unit volume of a material is called its density.

Solids have high densities because of strong forces of attraction.

Liquids usually have lower densities than solids because their particles are loosely packed as compared to solids.

Gases have the lowest densities because their particles are very far away from one another due to weakest forces of attraction among them.

Q.3 Give reasons:

(a) A gas fills completely the vessel in which it is kept.

(b) A gas exerts pressure on the walls of the container.

(c) A wooden table should be called a solid.

(d) We can easily move our hand in air but to do the same through a solid block of wood, we need a karate expert.

Ans.:

(a) A gas is able to fill the container because its particles are able to vibrate randomly in all the directions due to high kinetic energy as result they fill up the vessel completely in which they are kept.

(b) The particles of a gas have very high kinetic energy. They move randomly with high speeds in all directions. Due to this random movement, the particles hit each other and also the walls of the container. As a result, a gas exerts pressure on the walls of the container.

(c) A wooden table has a definite shape and a definite volume. The particles in a wooden table are tightly packed and have no intermolecular spaces and hence, it cannot be compressed. Since, a wooden table has the basic characteristics of a solid i.e. rigidity, definite shape and definite volume, it should be called a solid.

(d) We can easily move our hand in air but not do the same through a solid block of wood because of the differences in the intermolecular forces of attraction.Air has very low intermolecular force of attraction as result even small amount of force can separate air particles whereas in case of solids the intermolecular force of attraction are very strong and large amount of force is required to break them.This is the reason we can easily move our hand in air but t do the same through a solid block of wood we need a karate expert

Q. 4 Liquids generally have lower density as compared to solids. But you must have observed that ice floats on water. Find out why?

Ans.: The density of water is greater than ice cubes, hence ice cubes are lighter than water. This is why ice cubes are floats on water.

When water is in the solid state, it has dominant hydrogen bonds between its molecules which are very strong.

In this state, when the water molecules come close to each other, the molecules are forced to arrange themselves into a certain structure - a

hexagonal lattice that is the basis for the shape of the six-sided snowflakes.

So density is mass per volume so due to the increased bond angles and expanded molecular structure and, the volume is greater and the density is lower.

Questions:

Q.1 Convert the following temperatures to Celsius scale:

(a) 300 K

(b) 573 K

Ans.: (a) Kelvin is the SI unit of temperature. To change a temperature on the Kelvin scale to the Celsius scale you have to subtract 273 from the given temperature, and to convert a temperature on the Celsius scale to the Kelvin scale you have to add 273 to the given temperature.

Temp. on Kelvin scale = Temp. on Celsius scale + 273

300 K = Temp. on Celsius scale + 273

Temp. on Celsius scale=300 - 273 = 270C

Thus, a temperature of 300 K on Kelvin scale is equal to 270C on Celsius scale.

(b) Kelvin is the SI unit of temperature. To change a temperature on the Kelvin scale to the Celsius scale you have to subtract 273 from the given temperature, and to convert a temperature on the Celsius scale to the Kelvin scale you have to add 273 to the given temperature.

Temp. on Kelvin scale = Temp. on Celsius scale + 273

573 = Temp. on Celsius scale + 273

And, Temp. on Celsius scale= 573 - 273 = 300°C

Thus, a temperature of 573 K on Kelvin scale is equal to 300°C on Celsius scale.

Q.2 What is the physical state of water at:

(a) 250°C?

(b) 1000C?

Ans.: (a) Water will be in gaseous state at 250°C. The boiling point of water is 100°C. Heating the water above this temperature will change it into gaseous state.

(b) The boiling point of water is 100°C. At this temperature the liquid starts changing into gas. Boiling is a bulk phenomenon. Particles from the bulk of the liquid gain enough energy to change into the vapour state. Hence, the physical state of water at 100°C will be both 'liquid' and 'gaseous' state.

Q. 3 For any substance, why does the temperature remain constant during the change of state?

Ans.: The temperature remains constant during the change of state because the heat supplied is used up in changing the state of matter as it has to work against the force of attraction of molecules.

Q.4 Suggest a method to liquefy atmospheric gases.

Ans.: Atmospheric gases can be liquefied by applying pressure and reducing the temperature.When pressure is applied on a gas at a reduced temperature, its molecules get closer and they start attracting one another to form a liquid. When a gas is compressed by applying high pressure, a lot of heat is produced. So, while applying high pressure, it is necessary to keep the temperature low which helps to take away the heat released during compression.

Questions:

Q. 1 Why does a desert cooler cool better on a hot dry day?

Ans.: The outer walls of the cooler are constantly sprinkled by water. This water evaporates at a faster rate during the hot dry weather causing a cooling effect in the inside air of the cooler which is sent in the room through a fan.On a hot dry day, humidity is very low so the cooler works efficiently

Q.2 How does the water kept in an earthen pot (matka) become cool during summer?

Ans.: Earthen pot is porous with a lot of pores on it. The water oozes out of these pores constantly. This water then gets evaporated through the pores quickly. Since, some heat energy is taken from the water during the process of evaporation. This process makes the pot cold which further cools down the water inside the pot.

Q.3 Why does our palm feel cold when we put some acetone or petrol or perfume on it?

Ans.: Acetone, petrol and perfume are volatile liquids. They change into vapours easily when they come in contact with the air. In order to change from the liquid to the vapour state, acetone, petrol or perfume requires latent heat of vaporisation. These liquids absorb this latent heat of vaporisation from our palm. As a result, heat energy is lost from the palm and it feels cold.

Q.4 Why are we able to sip hot tea or milk faster from a saucer than a cup?

Ans.: When hot tea or milk is taken in a saucer, its surface area is increased. Since, evaporation is a surface phenomenon. The rate of evaporation becomes faster with the increase in surface area. Tea or milk cools down faster in a saucer making it easier for a sip. On the other hand, when hot tea or milk is taken in a cup, surface area is comparatively small due to the narrow shape of the cup. Small surface area slows down the process of evaporation. Hence, tea or milk takes long time to cool in a cup which makes it difficult to take a sip.

Q.5 What type of clothes should we wear in summer?

Ans.: We should wear light colored cotton clothes in hot summer to keep us cool and comfortable.

- Light colour is preferred because it reflects heat. Because of our body mechanism we tend to perspire more during summers. This helps to keep our body cool. During evaporation, the particles at the surface of the liquid gain energy from the surroundings or body surface and change into vapour.
- The heat energy equal to the latent heat of vaporization is absorbed from the body leaving the body cool.
- Cotton, being a good absorber of water helps in absorbing the sweat and exposing it to the atmosphere and makes evaporation easy.

Exercise

Questions:

Q. 1 Convert the following temperatures to the Celsius scale:

(a) 293 K

(b) 470 K

Ans.: (a) Kelvin is the SI unit of temperature. The Relation between Kelvin and Celsius is as follow:-

Temp. on Kelvin scale= Temp. on Celsius scale + 273

According to Question:-

293K = Temp.On Celsius scale + 273.

∴On Celsius scale= 293- 273 = 20°C.

Therefore, 293 K is equal to 20°C.

(b) Kelvin is the SI unit of temperature. The Relation between Kelvin and Celsius is as follow:-

Temp. on Kelvin scale = Temp. on Celsius scale + 273

According to Question:-

470k = Temp. On Celsius scale + 273

∴Temp. on Celsius scale= 470- 273 = 197°C.

Therefore, 470 K is equal to 197°C.

Q.2 Convert the following temperatures to the Kelvin scale:

(a) 25°C

(b) 373°C

Ans.: (a) Kelvin is the SI unit of temperature.

Temp. on Kelvin scale = Temp. on Celsius scale + 273

Temp. on Kelvin scale= 25°C + 273 = 298 K

Therefore, 25°C = 298 K

(b) Kelvin is the SI unit of temperature.

Temp. on Kelvin scale= Temp. on Celsius scale + 273

= 373°C + 273 = 646 K

Therefore, 373°C = 646 K

Q. 3 Give reasons for the following observations:

(a) Naphthalene balls disappear with time without leaving any solid.

(b) We can get the smell of perfume sitting several metres away.

Ans.: (a) Naphthalene is a volatile organic compound which can undergo sublimation. It directly changes into vapour state without leaving any solid. The naphthalene balls sublimate completely forming naphthalene vapours and hence, they disappear without leaving any solid residue.

(b) Perfume contains a volatile solvent which diffuses into the air. When liquid perfume is applied, it quickly changes into vapours. As a result of diffusion, the perfume vapours move very rapidly in all directions in air, mix up with air particles and spread in the air. When this air containing perfume vapours reaches several meters away, we can smell the perfume.

Q. 4 Arrange the following substances in increasing order of forces of attraction between the particles -water, sugar, oxygen.

Ans.: The forces of attraction between the particles of a gas is minimum, intermediate in case of a liquid and are maximum in a solid.On the basis of this information we can arrange the following substances in increasing order of forces of attraction which is as follow:-

oxygen < water < sugar

*For Extra Information

(i) Oxygen is a gas, the forces of attraction between its particles will be the weakest.

(ii) Water is a liquid. The forces of attraction between its particles will be stronger than that of oxygen but will be weaker than that of sugar.

(iii) Sugar is a solid. The forces of attraction between its particles will be the strongest.

Q.5 What is the physical state of water at:

(a) 25°C (b) 0°C (c) 100°C

Ans.: (a) Between 0°C and 100°C water exists as a liquid. The physical state of water at 25°C is liquid.

(b) 0°C is the melting point of ice as well as the freezing point of water. Hence, the physical state of water can be both liquid and solid at 0°C.

(c) 100°C is the boiling point of water as well as the condensation temperature of steam. Hence, the physical state of water can be both liquid or gas at 100°C.

Q. 6 Give two reasons to justify:

(a) Water at room temperature is a liquid.

(b) An iron almirah is a solid at room temperature.

Ans.: (a) The freezing point of water is 0°C and the boiling point of water is 100°C. At room temperature the particles of water do not have enough energy to break free from the inter-molecular force of attraction of each . Hence, water remains as a liquid at room temperature.

(b) An iron almirah is solid at room temperature because melting point of iron i.e the temperature required to convert solid iron to liquid iron is much higher than the room temperature

Q.7 Why is ice at 273 K more effective in cooling than water at the same temperature?

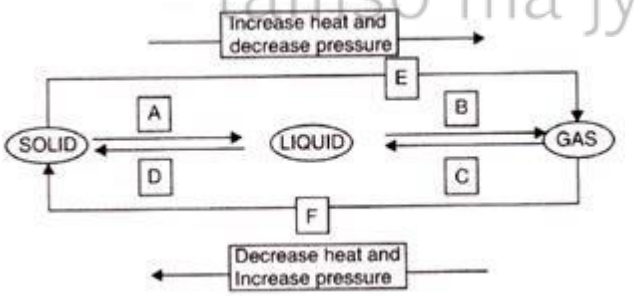
Ans.: 273 K or 0°C is the melting point of ice.Now, ice at 273 K is more effective in cooling a substance than water at the same temperature because in order to overcome the fusion to become water, ice at 273 K will absorb heat energy from the surroundings known as latent heat of fusion. Hence, the cooling effect of ice will be more than water at the same temperature because water does not absorb this extra heat from the medium.

The latent heat of melting of ice is 334 Joules per kilogram

Q.8 What produces more severe burns - boiling water or steam?

Ans.: Particles in steam, that is, water vapour at 373 K (100°C) have more energy than water at the same temperature. This is because particles in steam have absorbed extra energy in the form of latent heat of vaporisation. When steam tends to cool down, first steam condenses to water on skin and then water tends to cool down to the temperature of the skin. Since steam gives out much more heat than boiling water, it causes more severe burns.

Q.9 Name A, B, C, D, E and F in the following diagram showing changes in state:



Ans.: (i) In process A, a solid is changing into a liquid. Hence, A is melting or fusion.

The temperature at which a solid melts to become a liquid at the atmospheric pressure is called its melting point.

(ii) In process B, a liquid is changing into a gas. B is evaporation.The temperature at which a liquid starts boiling at the atmospheric pressure is known as its boiling point. Boiling is a bulk phenomenon. Particles from the bulk of the liquid gain enough energy to change into the vapour state.

(iii) In process C, a gas is changing into a liquid. C is condensation.

(iv) In process D, a liquid is changing into a solid. D is solidification.

(v) In process E, a solid is directly changing into a gas. E is sublimation which is done under increased heat and decreased pressure.

(vi) In process F, a gas is changing directly into a solid. F is also sublimation which is done under decreased heat and increased pressure.

The process of change of state of solid directly into a gas without changing into liquid state (or vice versa) is called sublimation

Class 9th Science (Chemistry)

01

MATTER IN OUR SURROUNDINGS

MIND MAP

Less dense than solids
Molecules can move within the container

Take shape of the container as it has no definite shape

Less compressible

Example: Milk, water

as it has no definite shape

as it has definite volume

Low density have molecules spread out

Condensation cool-down

Evaporation-add heat

Liquids

Freeze-cool down

melt

Can be

Occupy the shape of container

Gases

Can be

Can be

Solids

Have high density Molecules are closely packed solid

Hard to compress

Definite shape and volume

Example: ice, wood

Example: Air, hydrogen

compressed easily

Matter in Our Surroundings

less commonly known

less commonly known

Example: fluorescent lights in stars

Plasma

particles in excited state give of light

Bose Einstein Condensates

gas carrying electrical charge conduct

Example: lightning, Plasma Tvs

Form just above absolute zero (–273°C)

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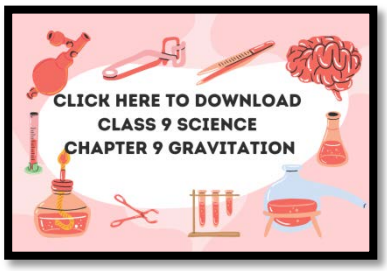

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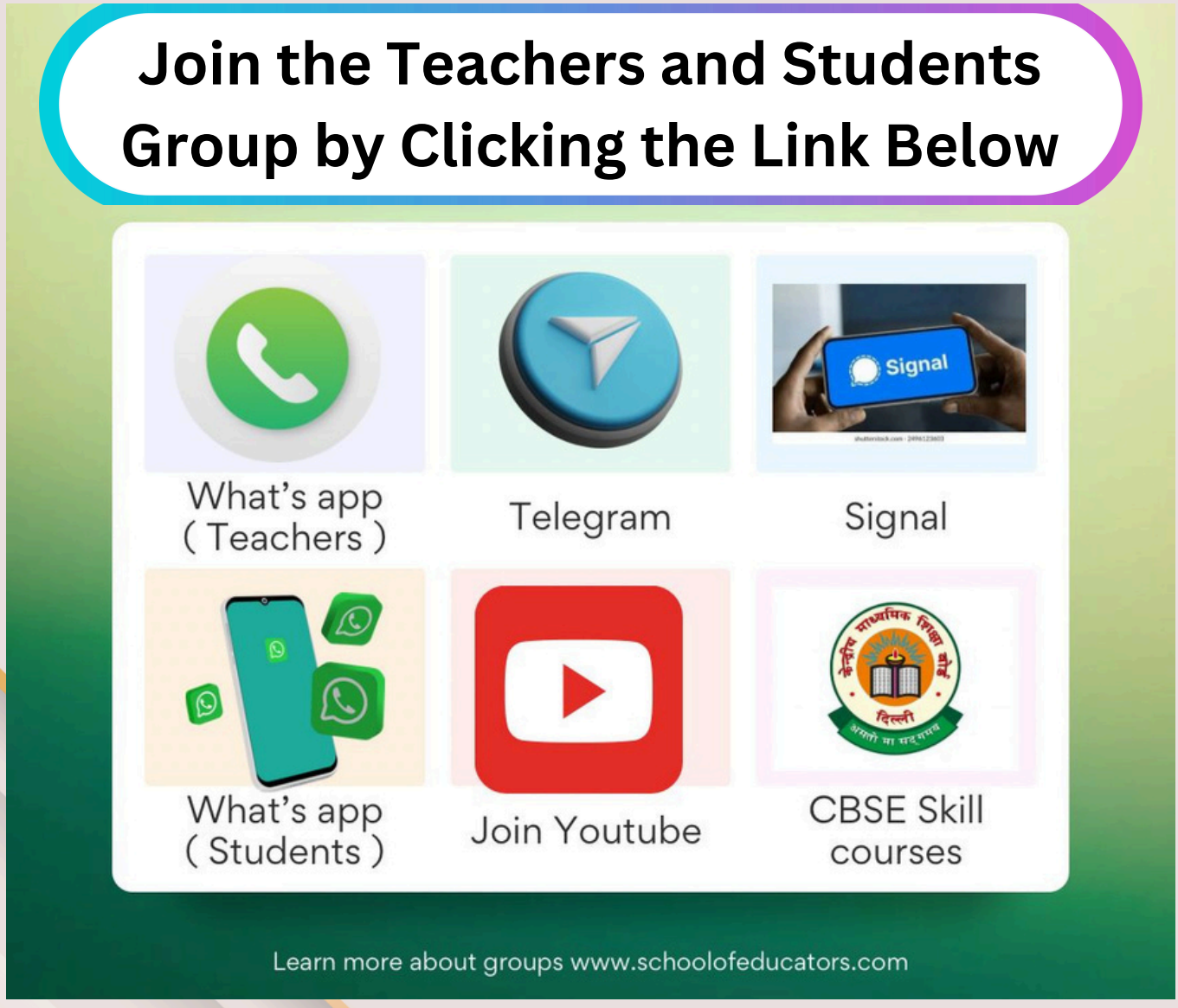

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Class 4

Class 5

Class 6

Class 7

Class 8

Class 9

Class 10

Class 11 (Science)

Class 11 (Humanities)

Class 11 (Commerce)

Class 12 (Science)

Class 12 (Humanities)

Class 12 (Commerce)

Kindergarten

Subject Wise Secondary and Senior Secondary Groups (IX & X For Teachers Only)

Secondary Groups (IX & X)

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Science

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English

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Hindi-A

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IT Code-402

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Artificial Intelligence

Senior Secondary Groups (XI & XII For Teachers Only)

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BST

Click Here to Join
History

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Click Here to Join

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Click Here to Join

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Click Here to Join

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Physical Education

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APP. Mathematics

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Legal Studies

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Entrepreneurship

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French

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Artificial Intelligence

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Principal's Group

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IIT/NEET

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Kindergarten to Class XII (For Students Only)

Class 1

Class 2

Class 3

Class 4

Class 5

Class 6

Class 7

Class 8

Class 9

Class 10

Class 11 (Science)

Class 11 (Humanities)

Class 11 (Commerce)

Class 12 (Science)

Class 12 (Humanities)

Class 12 (Commerce)

Artificial Intelligence
(VI TO VIII)

Subject Wise Secondary and Senior Secondary Groups (IX & X For Students Only)

Secondary Groups (IX & X)

SST

Mathematics

Science

English

Hindi

IT Code

Artificial Intelligence

Senior Secondary Groups (XI & XII For Students Only)

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1. Share your valuable resources with the group.
2. Help your fellow educators by answering their queries.
3. Watch and engage with shared videos in the group.
4. Distribute WhatsApp group resources among your students.
5. Encourage your colleagues to join these groups.

Additional notes:

1. Avoid posting messages between 9 PM and 7 AM.
2. After sharing resources with students, consider deleting outdated data if necessary.
3. It's a NO Nuisance groups, single nuisance and you will be removed.
   - No introductions.
   - No greetings or wish messages.
   - No personal chats or messages.
   - No spam. Or voice calls
   - Share and seek learning resources only.

Please only share and request learning resources. For assistance, contact the helpline via WhatsApp: +91-95208-77777.

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SKILL MODULES BEING OFFERED IN MIDDLE SCHOOL

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Beauty & Wellness

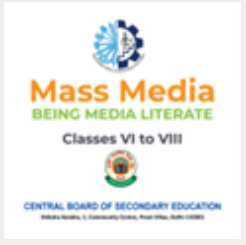
Design Thinking & Innovation

Financial Literacy

Handicrafts

Information Technology

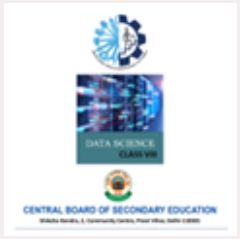
Marketing/Commercial Application



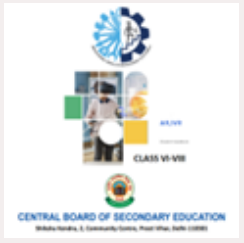
Mass Media - Being Media Literate

Travel & Tourism

Coding



Data Science (Class VIII only)

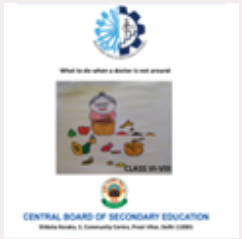


Augmented Reality / Virtual Reality

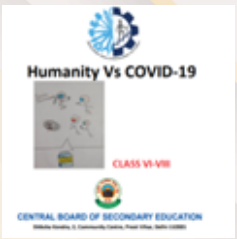
Digital Citizenship

Life Cycle of Medicine & Vaccine

Things you should know about keeping Medicines at home

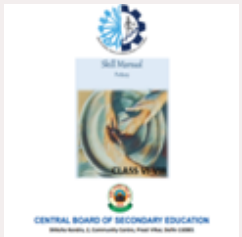


What to do when Doctor is not around



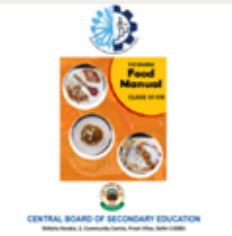
Humanity & Covid-19

Blue Pottery

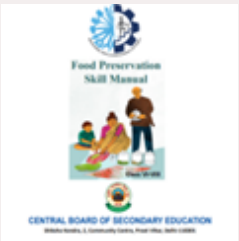


Pottery

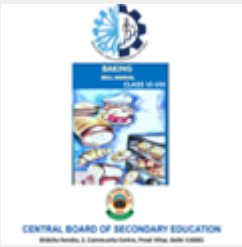
Block Printing



Food



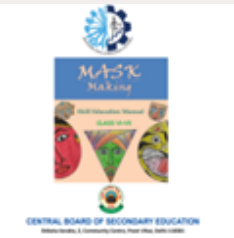
Food Preservation



Baking

Herbal Heritage

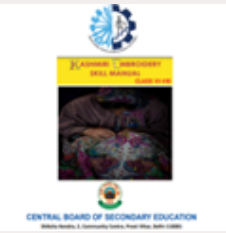
Khadi



Mask Making

Mass Media

Making of a Graphic Novel



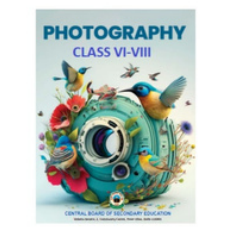
Kashmiri Embroidery

Embroidery

Rockets

Satellites

Application of Satellites

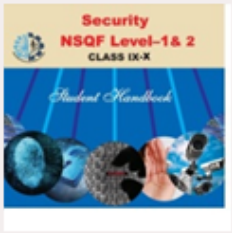


Photography

SKILL SUBJECTS AT SECONDARY LEVEL (CLASSES IX – X)

Retail

Information Technology



Security

Automotive

Introduction To Financial Markets

Introduction To Tourism

Beauty & Wellness

Agriculture

Food Production

Front Office Operations

Banking & Insurance

Marketing & Sales

Health Care

Apparel

Multi Media

Multi Skill Foundation Course

Artificial Intelligence

Physical Activity Trainer

Data Science

Electronics & Hardware (NEW)

Foundation Skills For Sciences (Pharmaceutical & Biotechnology)(NEW)

Design Thinking & Innovation (NEW)

SKILL SUBJECTS AT SR. SEC. LEVEL (CLASSES XI – XII)

Retail

InformationTechnology

Web Application

Automotive

Financial Markets Management

Tourism

Beauty & Wellness

Agriculture

Food Production

Front Office Operations

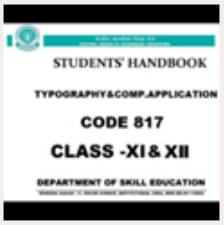
Banking

Marketing

Health Care

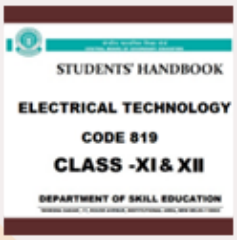
Insurance

Horticulture



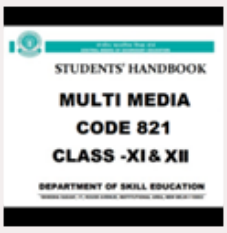
Typography & Comp. Application

Geospatial Technology



Electrical Technology

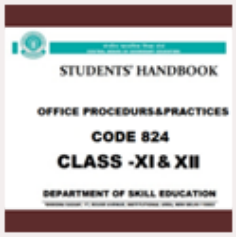
Electronic Technology



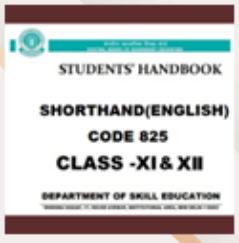
Multi-Media

Taxation

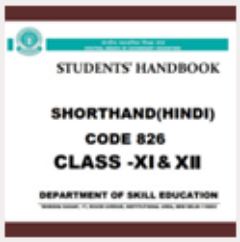
Cost Accounting



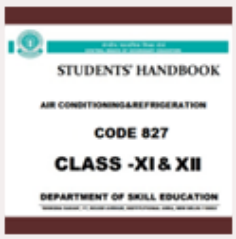
Office Procedures & Practices



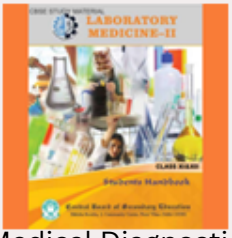
Shorthand (English)



Shorthand (Hindi)



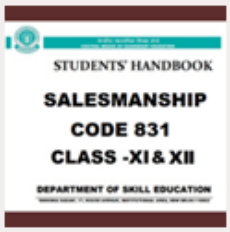
Air-Conditioning & Refrigeration



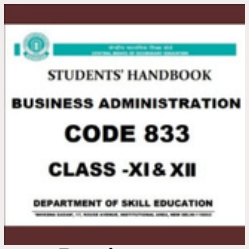
Medical Diagnostics

Textile Design

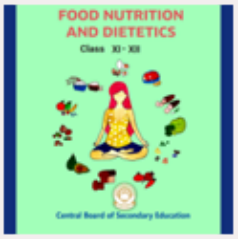
Design



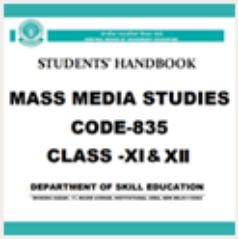
Salesmanship



Business Administration



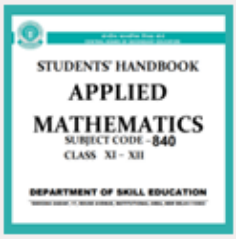
Food Nutrition & Dietetics



Mass Media Studies

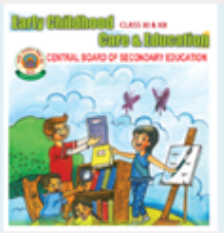
Library & Information Science

Fashion Studies



Applied Mathematics

Yoga

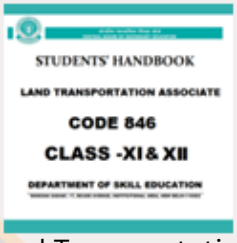


Early Childhood Care & Education

Artificial Intelligence

Data Science

Physical Activity Trainer(new)



Land Transportation Associate (NEW)

Electronics & Hardware (NEW)

Design Thinking & Innovation (NEW)

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Class 10

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Class 11 (Sci)

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Class 11 (Com)

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Class 11 (Hum)

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Class 12 (Com)

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Class 12 (Hum)

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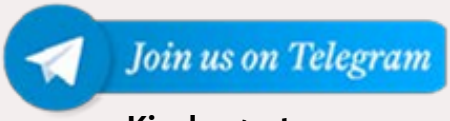
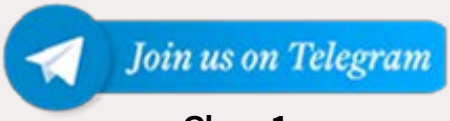
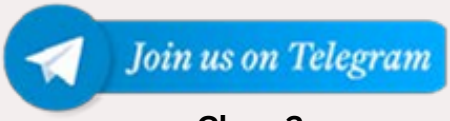


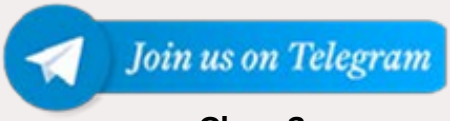
Kindergarten



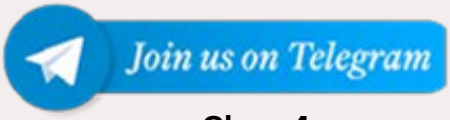
Class 1



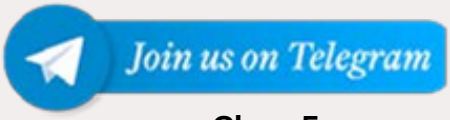
Class 2



Class 3

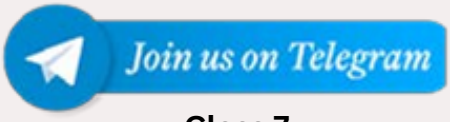


Class 4

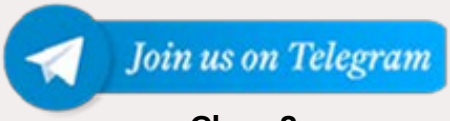


Class 5

Class 6



Class 7



Class 8

Class 9

Class 10

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Class 11 (Com)

Class 11 (Hum)

Class 12 (Sci)

Class 12 (Com)

Class 12 (Hum)

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